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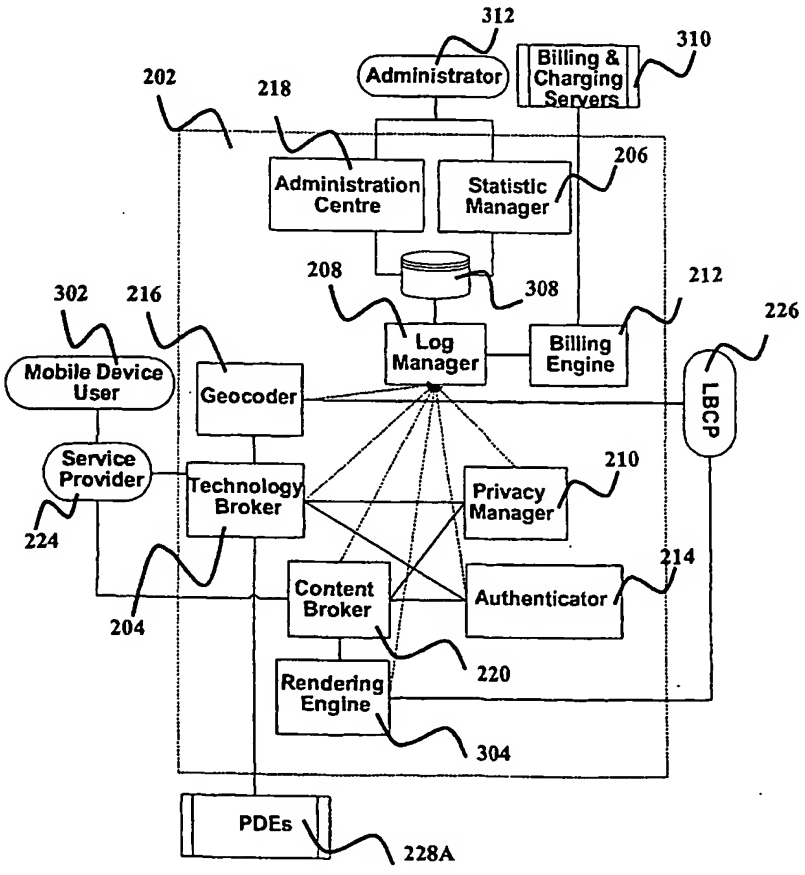
(54) Title: A SYSTEM FOR FACILITATING DELIVERY OF LOCATION-DEPENDENT INFORMATION TO MOBILE DEVICES



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(57) Abstract: A system for facilitating the provision of location-dependent information delivery services to mobile device users is disclosed. The system involves obtaining position data from positioning devices, which includes the system accepting a request for position data from a location-dependent information delivery service provider, and extracting from the request for position data the mobile device identification associated with a mobile device user. The system also provides a positioning device with the mobile device identification associated with the mobile de-vice user for obtaining positioning data relating to the mobile device user from the positioning device.

A SYSTEM FOR FACILITATING DELIVERY OF LOCATION-DEPENDENT INFORMATION TO MOBILE DEVICES

Field of invention

The invention relates generally to computer-based information delivery systems. The invention relates more particularly to computer-based systems for delivering location-dependent information.

Background

To be able to provide computer-based services for delivery of location-dependent information to mobile devices has long been regarded as an important goal for mobile telecommunication operators seeking to attain a commanding position in the mobile-Internet value chain. Such mobile devices include hand phones, Personal Digital Assistants (PDAs), Information Appliances (IAs) or the like devices.

With ownership of mobile telecommunication networks, mobile telecommunication operators applying appropriate positioning technologies may with a high degree of accuracy locate mobile telecommunication subscribers or users who are frequently on the move. By doing this, the mobile telecommunication operators therefore may provide value-added information delivery services to such users. Examples of such value-added information delivery services include services for providing a user's current location, services for locating another user, services for aiding vehicle navigation, services for locating and/or calling the nearest emergency help services, and services for providing advertisements which are only useful or meaningful to the user at the user's current location.

The Internet is a borderless communications platform upon which vast amounts of information is exchanged. In the early stages of the Internet's route to ubiquity, Internet users are restricted only to those who have access to the Internet from locations like home, offices, schools or the like places where there are fixed lines. Therefore, only such Internet users may access information delivery services via the Internet. Moreover, these information delivery services need only consider the fixed geographic location of the Internet users when delivering location-dependent information. The content of the information retrieved this way is represented by an Internet content domain 102 as shown in Fig. 1A.

With the emergence of Wireless Applications Protocol (WAP) for enabling mobile devices to retrieve information via wireless communication devices, mobile device users may also gain access to information delivery services while on the move. Part of the content of the information provided by such information delivery services via WAP is similar to the content of the information retrieved using the traditional Internet-based information delivery services. The content of the information retrieved this way is represented by a mobile device content domain 104, which overlaps the Internet content domain 102 to illustrate the similarity therebetween as shown in Fig. 1B.

Today, mobile device users who are on the move typically have special requirements relating to the content of the information acquired from any information delivery services accessible to the mobile device users. Such content may need to be customized according to where the mobile device users are located. In this way, the mobile device users may then obtain personalized and location-dependent information based on the mobile device users' needs and the mobile device users' current location, respectively. It is desirable therefore that part of the content of the information provided by location-dependent information delivery services is also similar to the content of the information retrieved from the traditional Internet-based or mobile device-based information delivery services. Such information content is represented by a location-dependent content domain 106, which overlaps both the Internet content domain 102 and the mobile device content domain 104 as shown in Fig. 1C.

The business logic and resources of a number of Internet- or mobile device-based information delivery services that are available today may be rejigged to deliver or provide information that is location-dependent, or "localized". Services providing information relating to advertisements, taxi bookings, weather forecasts, yellow pages, and driving directions are some examples of such location-dependent information delivery services. For example, information may be provided for facilitating the booking of a taxi without the need to inform taxi operators of a mobile device user's location, or the receiving of information such as the name of shops that are close to a mobile device user and are offering discounts or having promotions while the mobile device user is in a shopping area.

In addition, a number of new information delivery services may be introduced, for example, such as services for calling emergency help, finding people

and tracking assets.

The introduction of location-dependent information delivery services may also create a new type of business that is based on selling location information. Examples of location information include maps, maplets, driving directions, addresses and places or points of interests.

In the context of information delivery services, a service provider is a business entity that provides a Web service portal which may be Internet- or WAP-based for providing product- and/or service-related information and/or transaction services. Examples of service providers include fast food chains, taxi companies, restaurants, shops and etc. A content provider is a business entity that sells location information or content such as maps, driving directions, or the like information to service providers.

Business entities such as content providers, and/or mobile telecommunication operators are typically involved in location-dependent information delivery services provided by service providers. However, these business entities with existing business logic and resources currently face a number of difficulties, thereby preventing the feasible implementation and cost-effective and efficient delivery of location-dependent information.

For example, it is difficult for service providers such as fast food chains to provide maps in Web applications that are accessible through the fast food chains' Web portals because it is not cost-effective and efficient to maintain geographic information systems (GIS) or map engines for generating maps. This is because the maintenance of GIS or map engines do not typically directly relate to the core business of such service providers. Although a number of content providers are available, it is difficult for service providers to be kept abreast on the type of services or content these content providers sell. The service providers are therefore unable to appropriately choose the content providers to purchase content from, due generally to non-availability or lack of information on content providers.

Additionally, most content providers typically have interface requirements unique to the content providers' applications or systems that need to be met when requests for information are made to the content providers. Therefore, it is difficult for service providers to integrate localized content into the service providers' Web applications because there are numerous and different interfaces such as application program interfaces (APIs) used by different content providers, due to a lack of

interfacing standards among the content providers.

Furthermore, most positioning technologies, which are critical to the feasible implementation of location-dependent information delivery services, typically offer position data in the form of latitude and longitude information. To most service providers, such information is unintelligible or difficult to interpret and therefore not directly useful for providing location-dependent information delivery services. To some content providers, the preference is to provide information such as zones, provinces, and other similar useful information instead of latitude and longitude information.

Moreover, different mobile devices have different screen dimensions and sizes, and most content providers that sell maps typically do not customize the map size according to the different dimensions and sizes of screens. This is because these content providers typically do not have information regarding the different mobile devices, and therefore find impractical the implementation of rendering applications for fitting the dimensions and sizes of the maps to purchasers' requirements.

Also, most service providers find difficulty in justifying the commercial viability of providing location-dependent information delivery services because there is typically a lack of billing and charging infrastructure within the service providers' operations premises or accessible to the service providers.

In addition, mobile device user-positioning services provided by mobile telecommunication operators typically require mobile device users to manually key in the mobile device users' current locations because these mobile telecommunication operators have not implemented positioning technologies in the respective mobile telecommunication networks. Manual entry is both tedious and user-error prone, thereby making such services unpopular and therefore difficult to provide from a commercial standpoint.

In relation to non-manual or automatic positioning technologies, there are networkbased, network-independent, and hybrid technologies. The network-based technologies include Cell-Identity (ID), Time Difference of Arrival (TDOA), and Enhanced Observed Time Difference (E-OTD) technologies. The network independent technologies include GPS (Global Positioning System) technology and manual entry, and the hybrid technologies include A-GPS (Assisted Global Positioning System) technology.

A number of these positioning technologies are compared using Tables 1 to 4, namely Cell-ID, EOTD, GPS and A-GPS, in which:

Table 1 provides a comparison of the types of changes - whether hardware (HW), software (SW) or none – to be made to the mobile devices for implementation of the respective positioning technologies;

Table 1

Cell ID	EOTD	GPS	A-GPS
None/SW	SW	SW +HW	SW+HW

Table 2 provides a comparison of the additional costs - whether low, high or none – involved for implementing the respective positioning technologies;

Table 2

Cell ID	EOTD	GPS	A-GPS
None/low	Low	High	High

Table 3 provides a comparison of the positioning accuracies (in meters) afforded by the respective positioning technologies; and

Table 3

Cell ID	EOTD	GPS	A-GPS
100-1000m	75-300m	15-150m	1-100m

Table 4 provides a comparison of the times (in seconds) required for performing positioning by the respective positioning technologies.

Table 4

Cell ID	EOTD	GPS	A-GPS
<5 s	<5 s	10-16 s	<5 s

A number of problems are associated with these positioning technologies. For example, most of these positioning technologies are still in the early stages of improvement or redevelopment, and therefore position-determining equipment (PDE) used for performing positioning is expensive. Furthermore, accuracy is still a problem for most PDE, and limited interoperability exists between the various types of PDE supplied by different vendors. Moreover, some PDE require hardware and software changes to be made to both mobile devices and mobile telecommunication network equipment. Also, backup systems are seldom put in place to backup the PDE.

The functions and roles of a mobile telecommunication operator in the provision of location-dependent information delivery services may include providing a hub for positioning technologies, a hub for location services, billing and charging facilities, and a privacy control body.

The potential opportunities created for mobile telecommunication operators in the provision of location-dependent information delivery services may include the provision of positioning technology infrastructures. There are also potential opportunities for the mobile telecommunication operators to integrate networkindependent and network-based positioning technologies, and provide integrated positioning services. However, as the mobile telecommunication operators typically do not control any network-independent positioning technologies, the mobile telecommunication operators may attract the information delivery services market by offering existing billing and charging services, standard APIs, and etc. There are further potential opportunities for the mobile telecommunication operators to sell location information, and to provide different and flexible billing mechanisms involving as zone billing, accuracy billing, content billing, and etc.

Mobile telecommunication operators also face a number of problems in providing location-dependent information delivery services. Most positioning services using PDE products only provide position data in relation to core businesses.

However, in order to feasibly facilitate the provision of location-dependent information delivery services, the mobile telecommunication operators need to provide complete solutions that include services such as billing and charging, privacy management, providing standard APIs for interfacing with applications, providing position data to service providers and content providers, perform statistical analysis for predicting future trends, conversion of position data into intelligible and user-friendly information (Geocoding), convergence of different positioning technologies, and etc.

Additionally, a number of factors also affect the feasibility of providing location-dependent information delivery services. Firstly, a complex business model is required for the provision of location-dependent information delivery services. Furthermore, mobile telecommunication operators are faced with a situation in which there are a large number of positioning technologies to choose from. More importantly, revenues arising from providing airtime to mobile telecommunication users may decline in the near future, thereby leading mobile telecommunication operators to view traffic volume and value-added services as other revenue sources.

There is therefore a need for a system for facilitating the provision of location-dependent information delivery services to enable the feasible implementation thereof, thereby leading to cost-effective and efficient delivery of location-dependent information.

Summary

In accordance with a first aspect of the invention, there is provided a method for facilitating the provision of location-dependent information delivery services to mobile device users is disclosed. The method comprises the steps of obtaining position data from positioning devices, including accepting a request for position data from a location-dependent information delivery service provider, and extracting from the request for position data the mobile device identification associated with a mobile device user. The step of obtaining position data also includes providing a positioning device with the mobile device identification associated with the mobile device user for obtaining positioning data relating to the mobile device user from the positioning device.

In accordance with a second aspect of the invention, there is provided a

method for facilitating the provision of location-dependent information delivery services to mobile device users. The method comprises the steps of obtaining localized content from content providers, including accepting a request for localized content from a location-dependent information delivery service provider, and obtaining, by using the request for localized content, position data relating to a mobile device user. The step of obtaining localized content also includes providing a content provider with the position data relating to the mobile device user for obtaining localized content relating to the mobile device user from the content provider.

In accordance with a third aspect of the invention, there is provided a system for facilitating the provision of location-dependent information delivery services to mobile device users. The system comprises means for obtaining position data from positioning devices, including means for accepting a request for position data from a location-dependent information delivery service provider, and means for extracting from the request for position data the mobile device identification associated with a mobile device user. The means for obtaining position data from positioning devices also includes means for providing a positioning device with the mobile device identification associated with the mobile device user for obtaining positioning data relating to the mobile device user from the positioning device.

In accordance with a fourth aspect of the invention, there is provided a system for facilitating the provision of location-dependent information delivery services to mobile device users. The system comprises means for obtaining localized content from content providers, including means for accepting a request for localized content from a location-dependent information delivery service provider, and means for obtaining, by using the request for localized content, position data relating to a mobile device user. The means for obtaining localized content from content providers also includes means for providing a content provider with the position data relating to the mobile device user for obtaining localized content relating to the mobile device user from the content provider.

Brief Description Of The Drawings

Embodiments of the invention are described hereinafter with reference to the following drawings, in which:

Figs. 1A to 1C illustrate the interrelationships among the various content domains

relating to the Internet, mobile devices, and location-dependent systems, respectively;

Fig. 2 is a block diagram showing the components of a system for facilitating the provision of location-dependent delivery services according to embodiments of the invention;

Fig. 3 is a block diagram illustrating the interoperations among the components of the system of Fig. 2;

Fig. 4 is a block diagram illustrating operations involving sub-components of a technology broker component and other components shown in Fig. 3, and Figs. 4a to 4k are block diagrams of some sub-components and other components shown in Fig. 4 depicting specific events in the operations;

Fig. 5 is a block diagram illustrating operations involving sub-components of a content broker component and other components shown in Fig. 3, and Figs 5a to 5e are block diagrams of some sub-components and other components shown in Fig. 5 depicting specific events in the operations;

Fig. 6 is a block diagram illustrating operations involving sub-components of a billing engine component and other components shown in Fig. 3, and Figs. 6a to 6c are block diagrams of some sub-components and other components shown in Fig. 6 depicting specific events in the operations;

Fig. 7 is a block diagram illustrating operations involving a privacy managercomponent and other components shown in Fig. 3; and

Fig. 8 is a flowchart illustrating in greater detail a process related to an event depicted in Fig. 4f.

Detailed Description

A system for facilitating the provision of location-dependent information delivery services to enable the feasible implementation of the location-dependent information delivery services thereby leading to the cost-effective and efficient de-

livery of location- dependent information is hereinafter described. Such a system is hereinafter referred to generally as a Positioning Engine.

The Positioning Engine completes the location-dependent information delivery services value chain offered to mobile device users by providing the convergence between service providers and content providers, and positioning technologies. The Positioning Engine performs several roles, including the roles of a Content Broker and a Technology Broker. Other functions of the Positioning Engine include providing backup/redundancy mechanisms, opening up revenue models by providing common billing and charging capabilities, and providing a common privacy manager. The functions of the Positioning Engine also include providing statistical information by intelligently relating statistics from different positioning technologies and services so that mobile telecommunication operators who operate the Positioning Engine may easily predict potential markets and trends, providing geocoding, and providing authentication services to protect mobile telecommunication operators' investments.

The Positioning Engine communicates with service providers and content providers via a communications network, for example the Internet, using networking technology, for example Internet technology including Hyper Text Transmission Protocol (HTTP), Hyper Text Markup Language (HTML), Uniform Resource Locator (URL) and Application Program Interface (API). The Positioning Engine, however, communicates with different positioning technologies using typically proprietary interface, for example with mobile telecommunication operators' positioning devices or equipment using proprietary positioning device interface. As a further example, the mobile devices from which the mobile device users access the location-dependent information delivery services may be compliant with the Global System for Mobile communication (GSM) standard, in which case the GSM mobile telecommunication network operator would employ GSM related positioning devices for locating the mobile device users.

As shown in Fig. 2, the main components of the Positioning Engine (hereinafter designated the reference numeral 202) include a Technology Broker 204, a Statistic Manager 206, a Log Manager 208, a Privacy Manager 210, a Billing Engine 212, an Authenticator 214, a Geocoder 216, an Administration Center 218, a Content Broker 220, and Open Content and Positioning API modules 222/223. The Positioning Engine 202 communicates with Service or Content providers 224

or 226, respectively, via the Open Content and Positioning API modules 222/223. The Positioning Engine 202 also communicates with Positioning Technologies Providers 228 for converging the different positioning technologies.

The functions of the Technology Broker 204 include the integration of PDE supplied by different vendors, and providing a backup mechanism so that if any one of the PDE fails, the Technology Broker 204 switches to another PDE. The Technology Broker 204 also handles dual band switching situations to ensure that mobile device users who switch mobile telecommunication frequency bands are still able to access the location-dependent information delivery services. This is because different mobile telecommunication networks are typically proprietary to different vendors, operating with different communication frequency bands, and different PDE typically work with different mobile telecommunication networks. The Technology Broker 204 also enables all mobile device users to access the location-dependent information delivery services, regardless of the type of mobile devices that are used for access.

The Statistic Manager 206 provides various kinds of statistics, and relates and generates intelligible statistics because the Positioning Engine 202 is a hub and is therefore capable of tracking all operations and events that occur in relation to the provision of the location-dependent information delivery services. The Log Manager 208 logs all operations and events for tracking purposes, while the Privacy Manager 210 handles privacy issues relating to mobile device users 302 for the Positioning Engine 202 by allowing mobile device users to choose whether or not to reveal the mobile device users' current positions.

The Billing Engine 212 generates call data records (CDR) for billing and charging purposes, and allows for different ways of billing and charging mobile device users, for example using zone- or accuracy-based positioning charging methods. The Authenticator 214 provides authentication of mobile device users, Service Providers 224, and Content Providers 226 so that mobile telecommunication operators may ensure that only valid mobile device users may make use of the location-dependent information delivery services.

The Geocoder 216 allows for the provision of different forms of position data in addition to latitude/longitude information. Most Service Providers 224 find such information useful because the Service Providers 224 typically do not have to process the raw latitude/longitude information. As such, the Service Providers 224

may make use of position data such as postal codes, zones, provinces, and places or points of interests as processed by the Geocoder 216.

The Administration Center 218 is a component through which the administration of the Positioning Engine 202 is performed, while the Content Broker 220 enables the Service Providers 224 to obtain localized content, for example the most appropriate map, from the Content Provider 226. The Service Providers 226 therefore do not have to search for the appropriate Content Providers 226 for procuring localized content. The Content Providers 226 may find in the Content Broker 220 an opportunity to create a new revenue and business model, because the Content Providers 226 may sell localized content to the Service Providers 224 in addition to traditionally selling the same directly to end-users.

The Open Content and Positioning API modules 222/223 relate to a common standard of open APIs and is made available to location-dependent application developers. By using these APIs, location-dependent application developers may obtain the current location of a mobile device user and localized contents such as maps, driving directions, and etc.

With reference to Fig. 3, the interoperations among the components of the Positioning Engine 202 are described in greater detail.

To access any location-dependent information delivery service provided by a Service Provider 224, a mobile device user 302 is first required to make a connection with the Service Provider 224. The Service Provider 224 in turn connects to the Positioning Engine 202 for requesting information, in particular from the Technology Broker 204 and the Content Broker 220. Thereafter, the Technology Broker 204 obtains position data from PDE 228A operated by the Positioning Technologies Providers 228. Using this information, the Content Broker 220 interoperates with a Rendering Engine 304 to obtain localized content from the location-based Content Provider (LBCP) 226. The Rendering Engine 304, in addition to performing other functions, provides information relating to the profile of the mobile device used by the mobile device user such as the size of the display of the mobile device. Both the Technology Broker 204 and Content Broker 220 operate conjunctively with the Privacy Manager 210 and the Authenticator 214.

The Technology Broker 204 through the Geocoder 216 also obtains localized content from the location-based Content Provider 226 for processing and thereafter providing to the Service Provider 224, other forms of position data in

addition to raw latitude/longitude information.

The Technology Broker 204, the Content Broker 220, the Rendering Engine 300, the Privacy Manager 210, the Authenticator 214, and the Geocoder 216 provide information to the Log Manager 208 relating to all operations and events for tracking purposes. The Log Manager 308 processes such information and in turn stores such processed information at a repository 308. The Billing Engine 212 also retrieves such processed information from the Log Manager 208 and generates call data records for billing purposes. Billing Gateway/Charging Servers 310 (610) are then fed information from the Billing Engine 212 for billing the Service Provider 224 and other users of the Positioning Engine 202.

The Statistic Manager 206 and the Administration Center 218, meanwhile, may access the repository 308 to obtain information for administration and statistical analysis purposes, respectively. An Administrator 312 then accesses both the Statistic Manager 206 and the Administration Center 218 for performing system administration of the Positioning Engine 202.

With reference to Figs. 4 to 8, the operations and events that take place in the Positioning Engine 202, the Content Providers 226, and the Positioning Technologies Providers 228 for facilitating the provision of location-dependent information delivery services by the Service Providers 224, are described.

Technology Broker

Fig. 4 is a block diagram illustrating operations for obtaining position data, which involve sub-components in the Technology Broker 204, the Privacy Manager 210, and the Authenticator 214. The operations also involve the Service Provider 224, from which originates the request for information, the PDE 228A, which provides position data and the Open Positioning API module 222.

The Technology Broker 204 is an intelligent component that searches for the appropriate PDE 228A to use and allows the Service Provider 224 to not be concerned with the type of mobile device from which the mobile device user 302 makes the request for service to the Service Provider 224. The type of mobile device used by the mobile device user 302 determines the type of positioning technology to be employed, and therefore the type of PDE 228A to be selected. For instance, if the mobile telecommunication network to which the mobile device user 302 subscribes employs EOTD technology for positioning purposes, the mobile

device must then be embedded with a special software module for positioning purposes. On the other hand, if the mobile communication network employs GPS technology, the mobile device may then require an internal or external GPS receiver. With the Technology Broker 204, the Service Provider 224 does not need to have knowledge of the type of mobile device that the mobile device user 302 is using, because this information is automatically determined via the Technology Broker 204.

The Technology Broker 204 also ensures high availability of position data for every request because the Technology Broker 204 provides a backup mechanism where if a request to a particular PDE 228A fails or returns a negative response, the Technology Broker 204 switches to another PDE 228A which may provide a positive response. The sub-components of the Technology Broker 204 include a Request Handler A 402, a Request Parser 404, a Response Handler A 406, an Error/Reject Code Table 406A, a PDE Selector 408, a Request Handler B 410, and a Response Handler B 414.

As shown in Fig. 4a, the Service Provider 224 (the requestor) first requests for position data by sending a request 224A to the Request Handler A 402. The Request Handler A 402 forwards the request 224A to the Request Parser 404, in which a number of events occur. The Content Provider 226 may also be the requestor in certain instances because one Content Provider 226 may need other types of position data from another Content Provider 226 for processing the request 224A from the Service Provider 224.

Firstly, the Request Parser 404 strips the request string into a number of request elements (a and b) as shown in Fig. 4b. For example, one request element may provide information on the Mobile Station Integrated Services Digital Network (MSISDN) identification of the mobile device user 302 that is to be located, and while another request element may consists of a set of user identification (ID) and password of the requestor, in this instance being the Service Provider 224. Each of these request elements is then processed or handled by a different component.

As shown in Fig. 4c, the Privacy Manager 210 inspects any settings previously made by the mobile device user 302, based on the MSISDN identification of the mobile device user 302, whether the mobile device user 302 wish to be located. Meanwhile, the Authenticator 214 checks whether the Service Provider 224

is a valid user of the Positioning Engine 202.

If the mobile device user 302 does not wish to be located, the Request Parser 404 indicates this to the Response Handler A 406 by using a rejection code, as shown in Fig. 4d. The Response Handler A 406 then matches the rejection code with contents in the Error/Reject Code Table 406A, and returns an error message string 224B together with the rejection code to the requestor for processing.

Under the circumstances that the request 224A is valid after inspection by the Privacy Manager 210 and validation by the Authenticator 214, the Request Parser 404 informs the PDE Selector 408 to select the appropriate PDE 228A as shown in Fig. 4e.

The PDE Selector 408 is an important sub-component in the Technology Broker 204 because this sub-component ensures interoperability between the different types of PDE 228A and the Positioning Engine 202. The PDE Selector 408 through the Request Handler B 410 communicates with the appropriate PDE 228A as shown in Fig. 4f. Therefore with the PDE Selector 408, the Service Provider 224 or Content Provider 226 as the requestor need not have knowledge of the type of mobile device used by the mobile device user 302. The advantages afforded by the PDE Selector 408 are illustrated with reference to Figs. 4g and 4h.

Most positioning technologies require the upgrading of or modification to mobile devices, including the hardware and/or software, in order to function. For instance, to enable GPS technology, mobile devices need to have GPS receivers, whether external or internal, installed. As another example, to enable E-OTD technology, special mobile devices need to have new software modules added. As a further example, a Subscriber Identity Module (SIM) Application Toolkit (STK)-enabled SIM card is needed to enable the STK technology as a positioning technology to function. The SIM Application Toolkit involves a set of applications and related procedures that may be used during a GSM session involving a GSM mobile device, and provides a mechanism that allows the applications in SIM cards to interact and interoperate with the GSM mobile device.

However, there are positioning technologies which require minimal or no upgrading or modification in relation to mobile devices in order to function. For example, one such positioning technology involves a mobile telecommunication network sending timing advance signals to a mobile device to obtain the position of

the mobile device user. These timing advance signals are received and primarily used by the mobile device for advancing the mobile device's timings of transmissions to the mobile telecommunication network's base stations to compensate for propagation delay. The advantage is that this positioning technology does not require the mobile device user to have a specially upgraded or modified mobile device. The disadvantage, however, is that such a positioning technology may only operate within a special mobile telecommunication network which is not compatible with mobile telecommunication networks from other vendors.

In conventional situations when the Service Provider 224 or the Content Provider 226 has no knowledge of the type of mobile device used by the mobile device user 302, problems may arise as shown in Fig. 4g. Firstly, it is difficult for the Service Provider 224 or the Content Provider 226 to correctly determine the kind of positioning technology employed by the mobile telecommunication network to which the mobile device user 302 subscribes.

Also, different Positioning Technology Providers 228 have different sets of APIs 228B through which requests are made to the corresponding PDE 228A, thereby adding complexity to the problem of which positioning technology to be appropriately used for providing position data. This is illustrated by questions faced by Service Providers 224 as shown in Fig. 4g, which indicates that the Service Providers 224 do not know which set of APIs 228B to use to procure the services of the Positioning Technology Providers 228 because the Service Providers 224 do not have knowledge of the type of positioning technologies involved.

With the PDE Selector 408, however, these problems are alleviated. In Fig. 4h, the different types of PDE 228A and the corresponding sets of APIs 228B are conceptually viewed as a whole by the Service Providers 224, because the PDE Selector 408 allows for the translation of all the different APIs 228B into a common set of API, in this instance being the Open Positioning API module 222, which provides interfacing between the Positioning Engine 202 and the Service Providers 224. The PDE Selector 408 therefore helps to isolate all the different positioning technologies from the Service Providers 224 so that the Service Providers 224 need only deal with one common set of API. The chance of any mobile device user 302 not being located due to the selection of the wrong PDE 228A is thereby greatly reduced.

As a consequence, operators of the Positioning Engine 202 may invest in

different PDE 228A without worrying about incompatibility issues. These operators may also protect existing investments in old PDE because such equipment may still be used for backup purposes. The operators may also charge the Service Providers 224 less because of the lower accuracy of the old PDE even if the operators intend to upgrade to new positioning technologies. The operators therefore have more alternatives.

With reference to Fig. 4i, the operations of the PDE Selector 408 are briefly described. The PDE Selector 408 first automatically selects the appropriate PDE 228A for locating the mobile device user 302. To enable efficient and prompt response, a process for selecting the appropriate PDE 228A based on the history and accuracy of the previously selected PDE 228A is applied. After selecting the appropriate PDE 228A, the Request Handler B 410 selects the corresponding API 228B to make the request for obtaining position data from that PDE 228A.

When the selected PDE 228A fails to locate the mobile device user 302, there are two possible ways for the Technology Broker 202 to process or handle the resulting negative response as shown in Fig. 4j. If there are other PDE 228A from which the PDE Selector 408 may try to request position data, the PDE Selector 408 is again invoked. However, if all the options are exhausted, the Response Handler B 410 then indicates to the Response Handler A 406 another error code. The error code and message string 224B are then returned to the Service Provider 224 for processing.

If the resulting response is positive, the Response Handler B 410, as shown in Fig. 4k, returns a set of latitude and longitude data 224C in relation to the mobile device user 302 to the requestor for processing.

The process for selecting the appropriate PDE 228A is described in greater detail with reference to Fig. 8. The PDE Selector 408 maintains two types of database in relation to the mobile device user 302: a history list stating the number of times each different PDE 228A is used to locate the mobile device user 302; and an accuracy list, which is created each time a request is received, containing a list of PDE 228A arranged in a descending order of accuracy where the PDE 228A providing the best accuracy is placed at the top of the accuracy list while any inaccurate or unsuccessful PDE 228A is marked.

The process begins with step 802, and in step 804, the PDE Selector 408 reads the input to the PDE Selector 408. The PDE Selector 408 then checks the

type of input received in step 806, and if the input is a new request, the PDE Selector 408 in step 808 checks the number of entries in the history list. Otherwise if the input is a failed response for a previous request, the PDE Selector 408 proceeds to step 832.

If the number of entries in the history list is one, the PDE 228A listed is selected or assigned in step 810 to provide position data. The response from this PDE 228A is then checked in step 812, where if the response is positive, i.e. the mobile device user 302 is located and therefore position data is provided, the PDE Selector 408 increments in step 814 by one the number of times this PDE 228A is used to locate the mobile device user 302 in the history list. Thereafter, the process terminates in step 816.

However, if this PDE 228A is unable to locate the mobile device user 302, the PDE 228A is marked in the accuracy list in step 817, and the process loops back to step 804 where further input is read.

If the number of entries in the history list is more than one, the first two PDE 228A on the history list is compared in respect of the number of assignments listed against the PDE 228A in step 818. If the number of assignments for the first two PDE 228A on the history list is equal, the PDE Selector 408 in step 820 checks the accuracy list for the PDE 228A with the better accuracy and assigns this PDE 228A. The response from this PDE 228A is checked in step 822, where if this PDE 228A successfully locates the mobile device user 302, the PDE Selector 408 proceeds to step 814 to increment by one the number of assignments against this PDE 228A in the history list. If the response is negative, the PDE Selector 408 in step 824 marks this PDE 228A in the accuracy list and the process loops back to step 804 where the PDE Selector 408 reads the input.

However, if the number of assignments for the first two PDE 228A on the history list is not equal, the PDE Selector 408 in step 826 checks whether the second PDE 228A is higher on the accuracy list. If the second PDE 228A is not higher on the accuracy list, the first PDE 228A is assigned in step 828, and the response from the first PDE 228A checked in step 822. If the second PDE 228A is higher on the accuracy list, the second PDE 228A is assigned in step 830, and the response from the second PDE 228A also checked in step 822.

If the type of input checked in step 806 is a failed response for a previous request, or if the number of entries in the history list checked in step 808 is zero,

the PDE Selector 408 selects the next PDE 228A in the accuracy list which is unmarked. The accuracy list is checked in step 834 and if the accuracy list is not exhausted, the response from the next PDE 228A in the accuracy list is checked in step 836. If the response is negative, this PDE 228A is marked in the accuracy list in step 838. If this PDE 228A successfully locates the mobile device user 302, the number of times the PDE 228A is used the history list is incremented by one in step 814.

If the accuracy list is found to be exhausted, the PDE Selector 408 allows for manual entry by the mobile device user 302 to provide the mobile device user's 302 position data in step 840. The process then proceeds to step 814 where in the history list the number of times the PDE 228A is used is incremented by one. In this case, the increment is made against an entry which is created in the history for PDE 228A classified as "manual entry".

Content Broker

Fig. 5 is a block diagram illustrating operations for obtaining localized content, which involve sub-components in the Content Broker 220, the Technology Broker 204 and the Authenticator 214. The operations also involve the Service Provider 224, from which originates the request for information, the Content Provider 226, which provides localized content, and the Open Content API module 223. The sub-components of the Content Broker 220 include a Request Parser 504 and a Content Provider (CP) Router 506. The Open Content API module 223 includes a set of HTTP servlets known as Servlets B 502, while the Service Provider 224 maintains a set of servlets known as Servlets A 224D for interfacing with the Servlets B 502. Alternatively, the interface between the Content Broker 220 and the Service Provider 224 may be implemented using Common Gateway Interface (CGI) technology.

The primary purpose of the Content Broker 220 is to facilitate and allow the Service Provider 224 to easily include localized content into the Service Provider's 224 location-dependent application. For instance, if a fast-food restaurant chain, as the Service Provider 224, wants to make available the location of a restaurant in an area to potential customers in the same area using maps, the fast-food restaurant chain may through the Content Broker 220 conveniently purchase and use third party maps provided by a map provider, as the Content Provider

226. In addition, if the fast-food restaurant chain wishes to further provide potential customers, as mobile device users 302, with information on how to drive to the restaurant, the fast-food restaurant chain may purchase, again through the Content Broker 220, information relating to driving direction content from another Content Provider 226.

Therefore, the advantage afforded by the Content Broker 220 is that the Service Provider 224, or the fast-food restaurant chain in this instance, does not need to create maps or own a map engine to provide such a location-dependent information delivery service. This is because there already exists many specialized businesses that provide maps or own map engines in which maps and other related contents are typically well maintained and updated frequently.

For the Content Provider 226 and other similar businesses, selling maps and localized content online to the Service Provider 224 and other similar businesses through the Positioning Engine 202 provides another revenue source. With this arrangement, the Content Provider 226 may also have the option of charging the Service Provider 224 based on type or volume of localized content purchased, instead of traditionally generating revenue by offering periodic subscriptions.

Localized content includes information relating to maps, driving directions, bus routes, weather, traffic conditions, parking, and tourism.

The operations of the Content Broker 220 are described in greater detail with reference to Figs. 5a to 5e. When the Service Provider 224 needs a map for responding to a request for service in relation to the location-dependent application, the Service Provider 224 first selects and uses the appropriate API from the Open Content API module 223. The Open Content API module 223 is made available to the Service Provider 224 and any business that wish to obtain localized content from the Content Provider 226 and any similar business.

In an example shown Fig. 5a, if a "View Map" option is displayed on the mobile device used by the mobile device user 302 and selected, a request for content is generated for a map of the area the mobile device user 302 is in. In order to obtain such a map from the Content Provider 226 and deliver the location-dependent information to the mobile device user 302, the Service Provider 224 first conveys the request to the Servlet A 224D. The Servlet A 224D then calls the Servlet B 502, which contains an API to the Content Broker 220, where it is in the Servlet B 502 that a direct request is made to the Content Broker 220 to request

for the map. The function of the Servlet B 502 is to encapsulate the Service Provider's 224 user ID and password for privacy and security reasons.

The request next reaches the Request Parser 504 as shown in Fig. 5b, where the Request Parser 504 breaks the request into request elements a, b, c and d which provide information such as the Service Provider's 224 user ID and password, the mobile device user's 302 MSISDN identification or position data, indication of the Content Provider 226, and a specification of the localized content or any parameters specified in the API to the Content Broker 220, respectively.

After the request is broken down into the request elements, the Authenticator 214 next performs authentication on the Service Provider 224 using the user ID and password. If the Service Provider 224 is not a valid user of the Positioning Engine 202, the Request Parser 504 does not proceed further and an error message is returned to the Service Provider 224.

If the Service Provider 224 is a valid user, the Request Parser 504 then proceeds to examine the request element b. If the request element b is the mobile device user's 302 MSISDN, this indicates that the Service Provider 224 does not have any information on the location of the mobile device user 302. The Positioning Engine 202 then automatically locates the mobile device user 302 on behalf of the Service Provider 224 using the Technology Broker 204.

When this is the case, the authentication process is not replicated when the Technology Broker 204 performs operations to obtain the position data of the mobile device user 302 so as to reduce processing redundancy.

The request elements c and d are thereafter sent to the CP Router 506 as shown in Fig. 5c for the Content Broker 220 to identify the Content Provider 226 and specify to the Content Provider 226 the type of localized content that is requested. This is done by mapping the request elements c and d using previously stored information so that the request is forwarded correctly to the Content Provider 226.

A HTTP URL 306A is previously assigned to the Content Provider 226 and the CP Router 506 calls the HTTP URL 306A to retrieve information from a Map and Localized Content Engine 306B in the Content Provider 226.

Depending on the type of localized content requested, for example text or graphics, the Content Provider 226 may use standard templates 306c to format localized content so that Service Provider 224 may better anticipate the layout of the

localized content and customize the localized content accordingly.

As a result, the localized content returned by the Content Provider 226 is either in text or image format 508 as shown in Fig. 5d. This information is then cached in the Positioning Engine 202 for retrieval by the Service Provider 224.

As shown in Fig. 5e, the Content Broker 220 then sends a map/text link which indicates the location of the formatted localized content cached in the Positioning Engine 202 to the Servlet B 502 as a response to the original content request. If the result is an image such as a map, then a URL link is returned. Otherwise, a text document is returned.

The map/text link is in turn relayed to the Servlet A 224D, to which the Servlet A 224D then makes a request to the Positioning Engine 202 to retrieve the formatted localized content based on the map/text link and displays this on the mobile device used by the mobile device user 302.

Billing Engine

The Billing Engine 212 is described in greater detail with reference to Fig. 6 to 6c, which includes sub-components such as a Billing Data Parser 602, an Accuracy Determinator 604, and a CDR Generator 606. The Billing Engine 212 interoperates via a set of Billing/Charging APIs 608 with the Billing Gateway/Charging Server 310. The Billing Engine 212 also interoperates with the Log Manager 208.

The operator of the Positioning Engine 202 may be a mobile telecommunication network operator, in which case the mobile telecommunication network operator typically has an existing billing system for billing and charging mobile device users or subscribers. Hence, the Billing Engine 212 is not intended to replace the existing billing system, but to interoperate with the existing billing system so that call data records (CDRs) may be produced which are then sent to the billing system for processing.

The function of the Billing Engine 212 is to facilitate different kinds of charging capabilities, which includes charging according to zone, accuracy, and other characteristics relating to position data, and type of localized content. In order to achieve such charging capabilities, the Billing Engine 212 provides any information that is needed by the billing system via calling data records. A typical calling data record is a text string which consists of information relating to the MSISDN identification, the type of mobile telecommunication equipment used, the

type of PDE used, and other information.

The Billing Gateway/Charging Server 310 is an external billing system, which is typically vendor dependent, to which calling data records are sent for providing billing and charging services to the operator of the Positioning Engine 202.

Through the Billing/Charging APIs 608 the Billing Gateway/Charging Server 310 is used by external systems such as the Positioning Engine 202 for generating bills. The Billing/Charging APIs 608 accept inputs from the Billing Engine 212, and either the Billing/Charging APIs 608 or the Billing Engine 212 may generate calling data records. In the case where there is only the Billing Gateway 310, the Billing Gateway 310 then polls and obtains the calling data record for internal processing to generating of bills.

The Billing Engine 212 includes a billing and charging mechanism based on the accuracy of position data provided to the Service Provider 224, or position data relating to zones, provinces, or even the type of content provided by the Content Provider 226.

Since the Positioning Engine 202 is a hub through which location-dependent information delivery services are provided by the Service Provider 224 to the mobile device user 302, the Positioning Engine 202 therefore stores information relevant to, and is capable of analyzing, the events and corresponding traffic involved in the provision of such services. There are two ways of charging based on accuracy of position data, namely by determining the type of PDE 228A used for that request, and by analyzing the result of the position data. Good accuracy is typically associated with confidence level, whether it is a point, a circle, a sector, or etc.

Charging may also be based on the type of content, position data which relates to a zone which the mobile device user 302 is in, and the type of service/content provider. In relation to charging based on position data relating to zones, the operator of the Positioning Engine 202 may for example choose to charge less if the mobile device user 302 is located in an office, while charging more if the mobile device user 302 is located in a tourist attraction area.

The operations involved in billing and charging are described in greater detail with reference to Figs. 6a to 6c. As shown in Fig. 6a, the Billing Data Parser 602 first receives a complete log of events and corresponding traffic from the Log Manager 208. After receiving the complete log, the Billing Data Parser 602 breaks

down the complete log into basic elements. These elements include information such as time stamp, type of PDE 228A used, the Service Provider's 224 name, the MSISDN identification of the mobile device user 302 to be located, and etc.

Not all of the basic elements are required for billing purposes. The Billing Data Parser 602 decides which elements are required based on the API parameters provided by the Billing Gateway/Charging Server 610.

As shown in Fig. 6b, the accuracy of the position data requested relates to the level of precision based on the type of PDE 228A used for that request or by analyzing the result of the position data requested. The result is then sent to the CDR Generator 606. Unwanted elements are ignored and only mandatory elements are sent to the CDR Generator 606. The CDR Generator 606 places the elements into the parameters of the Billing/Charging APIs 608, which are then called for sending the elements to the Billing Gateway/Charging Server 610 for processing, as shown in Fig. 6c.

Privacy Manager

The primary function of the Privacy Manager 210 is to ensure that the privacy of a mobile device user 302 is not compromised. Through the Privacy Manager 210, the mobile device user 302 is provided the options to reveal the mobile device user's 302 location to all others or to only certain location-dependent information delivery services through a location feature. The provision to switch on or off the location option may be done via an interface relating to SMS, STK or WAP technologies.

When the mobile device user 302 disables the location feature, the mobile device user 302 as a result is not able to access all location-dependent information delivery services. The Privacy Manager 210 makes this possible and at the same time, ensures that mobile device user's 302 privacy is not adversely affected.

When the Privacy Manager 210 detects that the mobile device user's 302 locationfeature is disabled, the Privacy Manager 210 does not shut off all the informationdependent information delivery services that are accessible. Instead, the Privacy Manager 210 ensures that the mobile device user 302 is prompted by a page for a response as to whether the mobile device user 302 allows a particular location-dependent information delivery service the mobile device user 302 has chosen to locate the mobile device user 302.

If the mobile device user 302 responds affirmatively, then the particular location-dependent information delivery service is able to locate the mobile device user 302.

An example in which a series of events relating to the operation of the Privacy Manager 210 occurs is illustrated with reference to Fig. 7. The mobile device user 302 in event 702 selects a location-dependent information delivery service provided by the Service Provider 224. In event 704, the Service Provider 224 requests for service from the Positioning Engine 202, which thereafter performs a privacy check with the Privacy Manager 210 in event 706 using the location feature associated with the mobile device user 302. If the location feature is disabled, the Privacy Manager 210 in event 708 prepares for the Positioning Engine 202 a status indicating that the mobile device user 302 does not wish to be located. The Positioning Engine 202 in turn indicates to the Service Provider 224 in event 710 the mobile device user's 302 status, which thereafter in event 711 communicates to the mobile device user 302 information which includes the same status.

The mobile device user 302 in event 712 is redirected to the Positioning Engine 202 by the Service Provider 224 and provides the Positioning Engine 202 with information containing a return URL. The Positioning Engine 202 then in event 714 uses this information to send the mobile device user 302 a display page to request permission to be located from the mobile device user 302.

If the mobile device user 302 grants permission by responding to the request in event 716, the Privacy Manager 210 through the Positioning Engine 202 in event 718 is updated with such a status. The Privacy Manager 210 thereafter in event 720 confirms the update, and in event 722 the Positioning Engine 202 informs the same to the mobile device user 302.

The mobile device user 302 is also redirected to the Service Provider 224 in event 724 by the Positioning Engine 202 via the return URL (the page where the mobile device user 302 last visited), which in turn sends to the Positioning Engine 202 a request for position data in relation to the mobile device user 302 in event 726. The Positioning Engine 202 in event 728 checks the privacy status of the mobile device user 302 with the Privacy Manager 210, which in event 730 prepares a status indicating that the mobile device user 302 wish to be located. The Positioning Engine 202 through the Technology Broker 204 then requests position data from PDE 228A in event 732, which in turn in event 734 provides position

data relating to the mobile device user 302. The Positioning Engine 202 then in event 736 sends the position data to the Service Provider 224, which in turn in event 738 processes the position data by requesting and obtaining localized content for displaying the location-dependent information on the mobile device of the mobile device user 302.

Rendering Engine

The Rendering Engine 304 ensures that the localized content retrieved from the Content Provider 226 is displayed according to the size of the display or screen of the mobile device used by the mobile device user 302.

The Positioning Engine 202 includes a database that consists of mobile device profiles such as a device string from a user agent field found in the request header where the agent field is unique to the mobile device, the mobile device type, and the dimension of the screen size in pixels.

When the Service Provider 224 requests for localized content consisting of a map, text or image, the Service Provider 224 has to send together with the request, the user agent information to the Positioning Engine 202. The Positioning Engine 202, upon receiving the user agent information, matches the user agent information with those from the database. Upon making a match, the Rendering Engine 304 immediately determines the kind of mobile device that the mobile device user 302 is using and hence the dimension of the screen. When the Positioning Engine 202 is making requests for information to the Content Provider 226, the Positioning Engine 202 would inform the Content Provider 226 of the dimension of the screen. The Content Provider 226 then adjusts the image according to the dimension of the screen as provided by the Positioning Engine 202 before sending the result as a response back to the Positioning Engine 202, which then forwards the same to the Service Provider 224. The Positioning Engine 202 may also choose to adjust the size of the image or text.

The Rendering Engine 304 also facilitates the addition of a new mobile device to the database easily, which may be done via the new mobile device. For example, when a mobile device is introduced to the market, the Administrator 312 easily uses the new mobile device to update the Rendering Engine 304 database. First, the Administrator 312 uses the WAP facilities on the new mobile device to connect to a URL designating the Positioning Engine 202. The Positioning Engine

202 uses a servlet or CGI technology to extract the user agent information from the request header and update the user agent string on the Rendering Engine 304 database. The Administrator 312 is then requested via a WML page to enter the dimension of the mobile device phone and the mobile device type, which is also updated on the database.

In the foregoing manner, a system for facilitating the provision of location-dependent information delivery services is described. It is apparent to one skilled in the art in view of the foregoing description that numerous changes and/or modifications may be made without departing from the scope and spirit of the invention.

CLAIMS

1. A method for facilitating the provision of location-dependent information delivery services to mobile device users, the method comprising the steps of:

obtaining position data from positioning devices, including accepting a request for position data from a location-dependent information delivery service provider;

extracting from the request for position data the mobile device identification associated with a mobile device user; and

providing a positioning device with the mobile device identification associated with the mobile device user for obtaining positioning data relating to the mobile device user from the positioning device.

2. The method as in claim 1, wherein the step of obtaining position data further includes selecting the positioning device for obtaining position data.

3. The method as in claim 2, wherein the step of selecting the positioning device includes automatically selecting the positioning device for obtaining positioning data.

4. The method as in claim 3, wherein the step of automatically selecting the positioning device includes selecting the positioning device based on the selection history of the positioning device.

5. The method as in claim 3, wherein the step of automatically selecting the positioning device includes selecting the positioning device based on the accuracy of the positioning device.

6. The method as in claim 2, wherein the step of accepting the request for position data from the location-dependent information delivery service provider includes using an open interface for accepting the request for position data.

7. The method as in claim 6, wherein the step of using a first open interface

for accepting the request for position data includes using an application program interface.

8. The method as in claim 2, wherein the step of extracting from the request for position data the mobile device identification associated with the mobile device user includes extracting from the request for position data the mobile device identification of the mobile device that is GSM compliant.

9. The method as in claim 8, wherein the step of extracting from the request for position data the mobile device identification of the GSM mobile device includes extracting from the request for position data the MSISDN identification of the GSM mobile device.

10. The method as in claim 2, wherein the step of obtaining position data further includes obtaining latitude and longitude information for the location of the mobile device user.

11. The method as in claim 2, further comprising the step of providing a location feature upon which options for locating the mobile device user is dependent, wherein when the location feature is disabled the mobile device user is not locatable, and when the location feature is enabled the mobile device user is locatable.

12. The method as in claim 11, wherein when the location feature is disabled the step of providing the location feature includes prompting the mobile device user for obtaining permission for locating the mobile device user.

13. The method as in claim 2, further comprising the step of billing the location-dependent delivery service provider for procuring the position data based on the accuracy of the position data.

14. The method as in claim 13, wherein the step of billing the location-dependent delivery service provider includes using calling records generated in relation to calling events occurring during the obtaining of the position data from the positioning device.

15. The method as in claim 2, further comprising the steps of:

obtaining localized content from content providers, including

accepting a request for localized content from the location-dependent information delivery service provider;

obtaining, by using the request for localized content, position data relating to the mobile device user; and

providing a content provider with the position data relating to the mobile device user for obtaining localized content relating to the mobile device user from the content provider.

16. The method as in claim 15, wherein the step of obtaining the position data includes extracting from the request for localized content, the type of localized content to be obtained.

17. The method as in claim 16, wherein the step of obtaining the position data further includes extracting from the request for localized content, the position data.

18. The method as in claim 16, wherein the step of obtaining the position data further includes extracting from the request for localized content, the mobile device identification associated with a mobile device user.

19. The method as in claim 18, wherein the step of extracting from the request for localized content, the mobile device identification associated with the mobile device user includes providing a positioning device with the mobile device identification associated with the mobile device user for obtaining positioning data relating to the mobile device user from the positioning device.

20. The method as in claim 16, wherein the step of obtaining localized content further includes formatting the localized content obtained from the content provider.

21. The method as in claim 16, wherein the step of obtaining localized content further includes caching the localized content obtained from the content provider.

22. The method as in claim 16, wherein the step of providing the content provider with the position data relating to the mobile device user for obtaining the localized content relating to the mobile device user from the content provider includes pro viding the content provider with the position data relating to the mobile device user for obtaining text and/or image relating to the locality of mobile device user from the content provider.

23. The method as in claim 16, further comprising the step of rendering the localized content obtained from the content provider.

24. The method as in claim 23, wherein the step of rendering the localized content includes determining from the request for localized content the type of the mobile device.

25. The method as in claim 24, wherein the step of determining the type of the mobile device includes determining the screen size of the mobile device.

26. The method as in claim 25, wherein the step of determining the screen size of the mobile device includes matching the type of the mobile device against a data base for determining the screen size of the mobile device.

27. The method as in claim 26, wherein the step of matching the type of the mobile device against the database includes allowing new mobile device types to be added to the database.

28. A method for facilitating the provision of location-dependent information delivery services to mobile device users, the method comprising the steps of:

obtaining localized content from content providers, including

accepting a request for localized content from a location-dependent information delivery service provider;

obtaining, by using the request for localized content, position data relating to a mobile device user; and

providing a content provider with the position data relating to the mobile

device user for obtaining localized content relating to the mobile device user from the content provider.

29. The method as in claim 28, wherein the step of obtaining the position data includes extracting from the request for localized content, the type of localized content to be obtained.

30. The method as in claim 29, wherein the step of obtaining the position data further includes extracting from the request for localized content, the position data.

31. The method as in claim 29, wherein the step of obtaining the position data further includes extracting from the request for localized content, the mobile device identification associated with a mobile device user.

32. The method as in claim 31, wherein the step of extracting from the request for localized content, the mobile device identification associated with the mobile device user includes providing a positioning device with the mobile device identification associated with the mobile device user for obtaining positioning data relating to the mobile device user from the positioning device.

33. The method as in claim 29, wherein the step of obtaining localized content further includes formatting the localized content obtained from the content provider.

34. The method as in claim 29, wherein the step of obtaining localized content further includes caching the localized content obtained from the content provider.

35. The method as in claim 29, wherein the step of providing the content provider with the position data relating to the mobile device user for obtaining the localized content relating to the mobile device user from the content provider includes providing the content provider with the position data relating to the mobile device user for obtaining text and/or image relating to the locality of mobile device user from the content provider.

36. The method as in claim 29, further comprising the step of rendering the localized content obtained from the content provider.

37. The method as in claim 36, wherein the step of rendering the localized content includes determining from the request for localized content the type of the mobile device.

38. The method as in claim 37, wherein the step of determining the type of the mo bile device includes determining the screen size of the mobile device.

39. The method as in claim 38, wherein the step of determining the screen size of the mobile device includes matching the type of the mobile device against a database for determining the screen size of the mobile device.

40. The method as in claim 39, wherein the step of matching the type of the mobile device against the database includes allowing new mobile device types to be added to the database.

41. The method as in claim 29, further comprising the step of billing the location-dependent delivery service provider for procuring the position data based on the accuracy of the position data.

42. The method as in claim 41, wherein the step of billing the location-dependent delivery service provider includes using calling records generated in relation to calling events occurring during the obtaining of the localized content from the content provider.

43. The method as in claim 29, further comprising the steps of:

obtaining position data from positioning devices, including

accepting a request for position data from the location-dependent information delivery service provider;

extracting from the request for position data the mobile device identification associated with the mobile device user; and

providing a positioning device with the mobile device identification asso-

ciated with the mobile device user for obtaining positioning data relating to the mobile device user from the positioning device.

44. The method as in claim 43, wherein the step of obtaining position data further includes selecting the positioning device for obtaining position data.

45. The method as in claim 44, wherein the step of selecting the positioning device includes automatically selecting the positioning device for obtaining positioning data.

46. The method as in claim 45, wherein the step of automatically selecting the positioning device includes selecting the positioning device based on the selection history of the positioning device.

47. The method as in claim 45, wherein the step of automatically selecting the positioning device includes selecting the positioning device based on the accuracy of the positioning device.

48. The method as in claim 44, wherein the step of accepting the request for position data from the location-dependent information delivery service provider includes using an open interface for accepting the request for position data.

49. The method as in claim 48, wherein the step of using a first open interface for accepting the request for position data includes using an application program interface.

50. The method as in claim 44, wherein the step of extracting from the request for position data the mobile device identification associated with the mobile device user includes extracting from the request for position data the mobile device identification of the mobile device that is GSM compliant.

51. The method as in claim 50, wherein the step of extracting from the request for position data the mobile device identification of the GSM mobile device includes extracting from the request for position data the MSISDN identification of

the GSM mobile device.

52. The method as in claim 44, wherein the step of obtaining position data further includes obtaining latitude and longitude information for the location of the mobile device user.

53. The method as in claim 44, further including the step of providing a location feature upon which options for locating the mobile device user is dependent, wherein when the location feature is disabled the mobile device user is not locatable, and when the location feature is enabled the mobile device user is locatable.

54. The method as in claim 53, wherein when the location feature is disabled the step of providing the location feature includes prompting the mobile device user for obtaining permission for locating the mobile device user.

55. A system for facilitating the provision of location-dependent information delivery services to mobile device users, the system comprising:

means for obtaining position data from positioning devices, including

means for accepting a request for position data from a location-dependent information delivery service provider;

means for extracting from the request for position data the mobile device identification associated with a mobile device user; and

means for providing a positioning device with the mobile device identification associated with the mobile device user for obtaining positioning data relating to the mobile device user from the positioning device.

56. The system as in claim 55, wherein the means for obtaining position data further includes means for selecting the positioning device for obtaining position data.

57. The system as in claim 56, wherein the means for selecting the positioning device includes means for automatically selecting the positioning device for obtaining positioning data.

58. The system as in claim 57, wherein the means for automatically selecting the positioning device includes means for selecting the positioning device based on the selection history of the positioning device.

59. The system as in claim 57, wherein the means for automatically selecting the positioning device includes means for selecting the positioning device based on the accuracy of the positioning device.

60. The system as in claim 56, wherein the means for accepting the request for position data from the location-dependent information delivery service provider includes means for using an open interface for accepting the request for position data.

61. The system as in claim 60, wherein the means for using a first open interface for accepting the request for position data includes means for using an application program interface.

62. The system as in claim 56, wherein the means for extracting from the request for position data the mobile device identification associated with the mobile device user includes means for extracting from the request for position data the mobile device identification of the mobile device that is GSM compliant.

63. The system as in claim 62, wherein the means for extracting from the request for position data the mobile device identification of the GSM mobile device includes means for extracting from the request for position data the MSISDN identification of the GSM mobile device.

64. The system as in claim 56, wherein the means for obtaining position data further includes means for obtaining latitude and longitude information for the location of the mobile device user.

65. The system as in claim 56, further comprising means for providing a location feature upon which options for locating the mobile device user is dependent, wherein when the location feature is disabled the mobile device user is not loca-

table, and when the location feature is enabled the mobile device user is locatable.

66. The system as in claim 65, wherein when the location feature is disabled the means for providing the location feature includes means for prompting the mobile device user for obtaining permission for locating the mobile device user.

67. The system as in claim 56, further comprising means for billing the location-dependent delivery service provider for procuring the position data based on the accuracy of the position data.

68. The system as in claim 67, wherein the means for billing the location-dependent delivery service provider includes means for using calling records generated in relation to calling events occurring during the obtaining of the position data from the positioning device.

69. A system for facilitating the provision of location-dependent information delivery services to mobile device users, the system comprising:

means for obtaining localized content from content providers, including

means for accepting a request for localized content from a location-dependent information delivery service provider;

means for obtaining, by using the request for localized content, position data relating to a mobile device user; and

means for providing a content provider with the position data relating to the mobile device user for obtaining localized content relating to the mobile device user from the content provider.

70. The system as in claim 69, wherein the means for obtaining the position data includes means for extracting from the request for localized content, the type of localized content to be obtained.

71. The system as in claim 70, wherein the means for obtaining the position data further includes means for extracting from the request for localized content, the position data.

72. The system as in claim 70, wherein the means for obtaining the position data further includes means for extracting from the request for localized content, the mobile device identification associated with a mobile device user.

73. The system as in claim 72, wherein the means for extracting from the request for localized content, the mobile device identification associated with the mobile device user includes means for providing a positioning device with the mobile device identification associated with the mobile device user for obtaining positioning data relating to the mobile device user from the positioning device.

74. The system as in claim 70, wherein the means for obtaining localized content further includes means for formatting the localized content obtained from the content provider.

75. The system as in claim 70, wherein the means for obtaining localized content further includes means for caching the localized content obtained from the content provider.

76. The system as in claim 70, wherein the means for providing the content provider with the position data relating to the mobile device user for obtaining the localized content relating to the mobile device user from the content provider includes means for providing the content provider with the position data relating to the mobile device user for obtaining text and/or image relating to the locality of mobile device user from the content provider.

77. The system as in claim 70, further comprising means for rendering the localized content obtained from the content provider.

78. The system as in claim 77, wherein the means for rendering the localized content includes means for determining from the request for localized content the type of the mobile device.

79. The system as in claim 78, wherein the means for determining the type of

the mobile device includes means for determining the screen size of the mobile device.

80. The system as in claim 79, wherein the means for determining the screen size of the mobile device includes means for matching the type of the mobile device against a database for determining the screen size of the mobile device.

81. The system as in claim 80, wherein the means for matching the type of the mobile device against the database includes means for allowing new mobile device types to be added to the database.

82. The system as in claim 70, further comprising means for billing the location-dependent delivery service provider for procuring the position data based on the accuracy of the position data.

83. The system as in claim 82, wherein the means for billing the location-dependent delivery service provider includes means for using calling records generated in relation to calling events occurring during the obtaining of the localized content from the content provider.

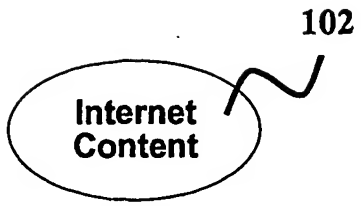

Fig. 1A

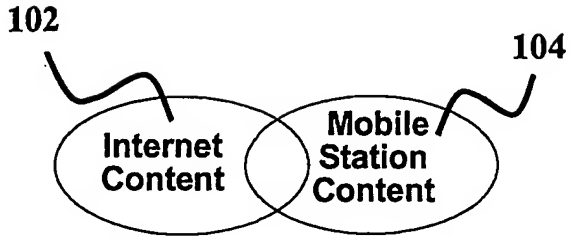

Fig. 1B

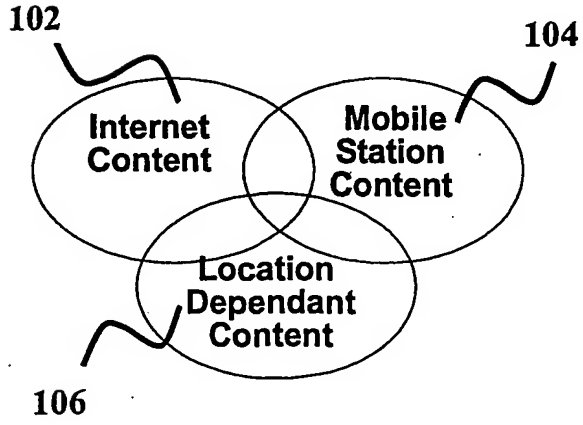

Fig. 1C

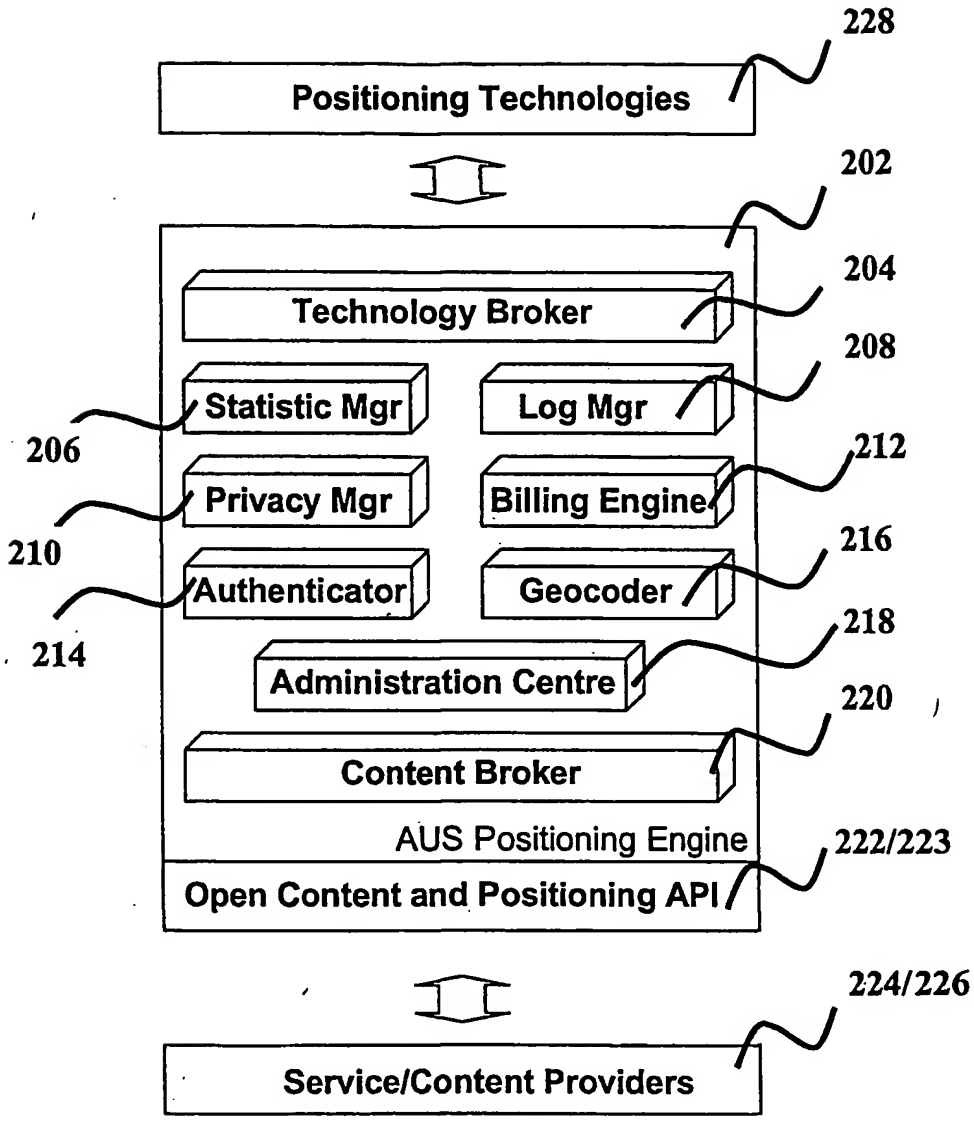
228
Positioning Technologies
202
204
Technology Broker
208
Statistic Mgr
Log Mgr
206
212
Privacy Mgr
Billing Engine
210
216
Authenticator
Geocoder
214
218
Administration Centre
220
Content Broker
AUS Positioning Engine
222/223
Open Content and Positioning API
224/226
Service/Content Providers

Fig. 2

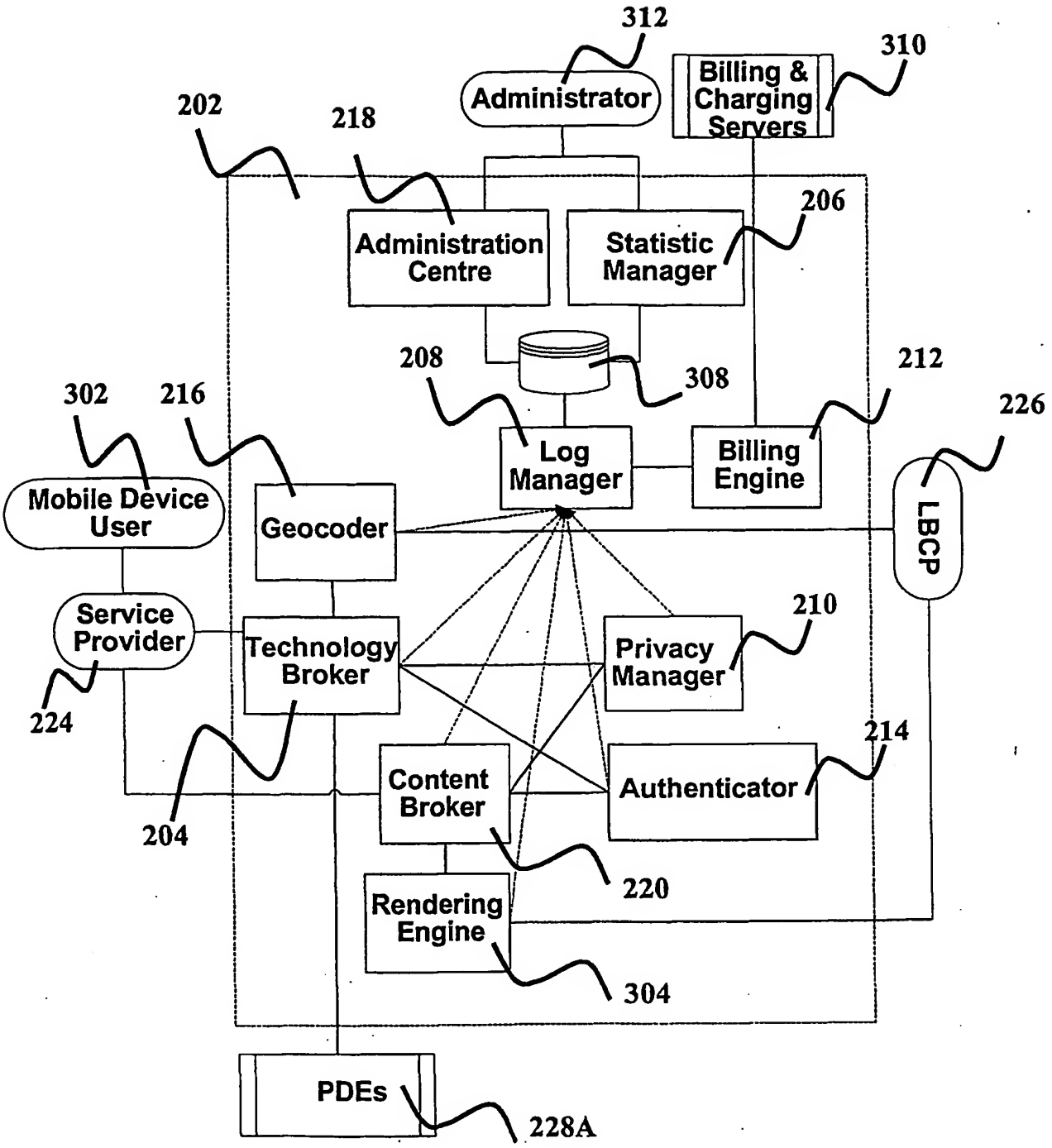
312
Administrator
310
Billing & Charging Servers
202
218
Administration Centre
206
Statistic Manager
208
308
212
226
302
216
Mobile Device User
Geocoder
Log Manager
Billing Engine
LBCP
Service Provider
Technology Broker
210
Privacy Manager
224
214
Content Broker
Authenticator
204
220
Rendering Engine
304
PDEs
228A

Fig. 3

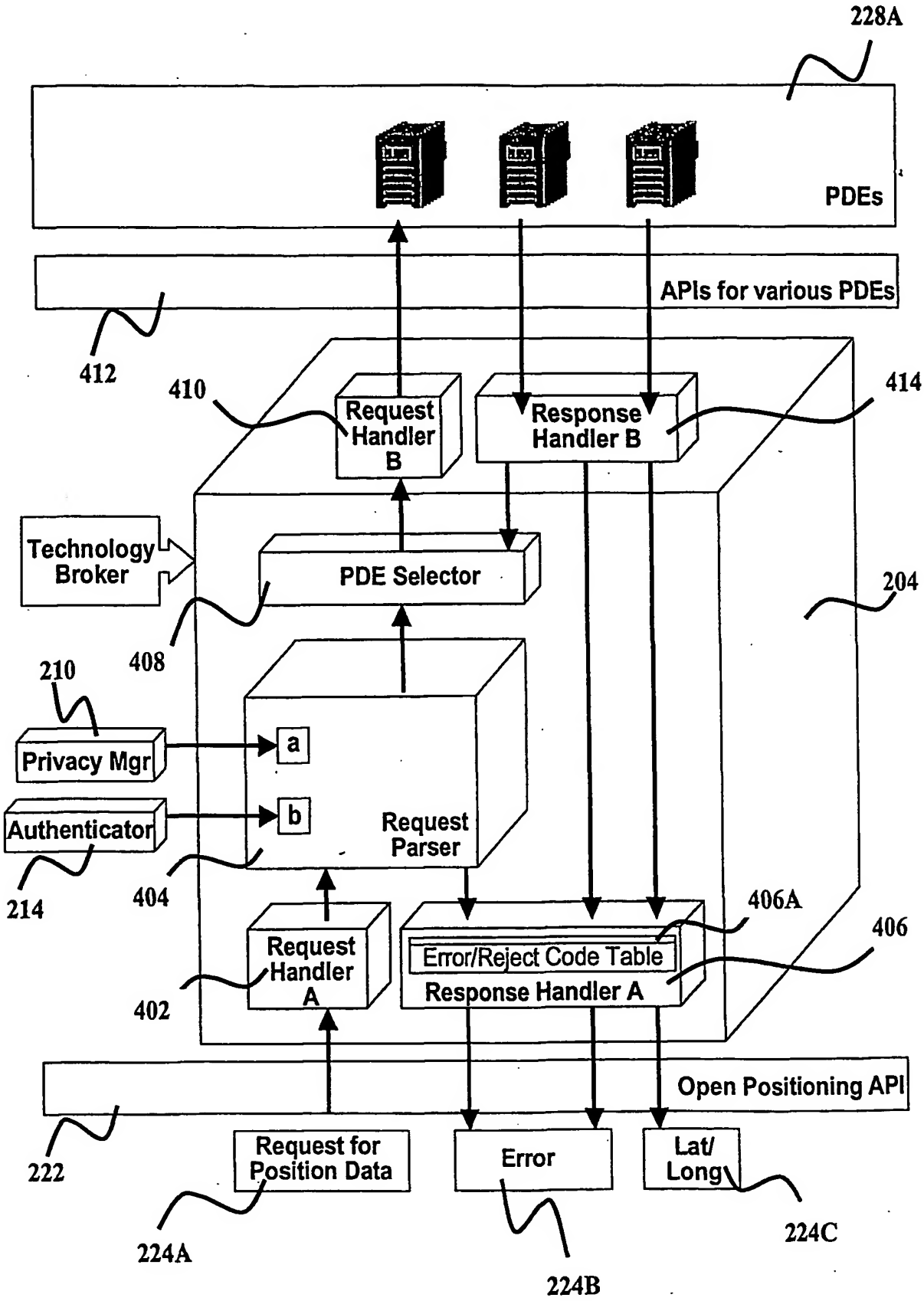
228A
PDEs
APIs for various PDEs
412
410
Request Handler B
Response Handler B
414
Technology Broker
PDE Selector
204
408
210
Privacy Mgr
a
Authenticator
b
Request Parser
214
404
406A
406
Request Handler A
Error/Reject Code Table
Response Handler A
402
Open Positioning API
222
Request for Position Data
Error
Lat/ Long
224A
224B
224C

Fig. 4

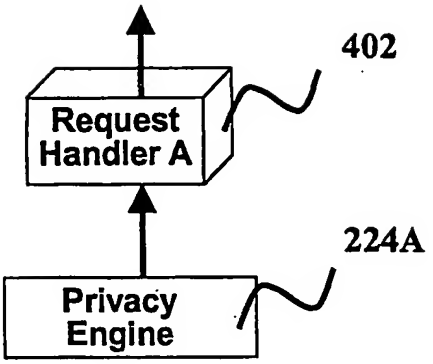

Fig. 4a

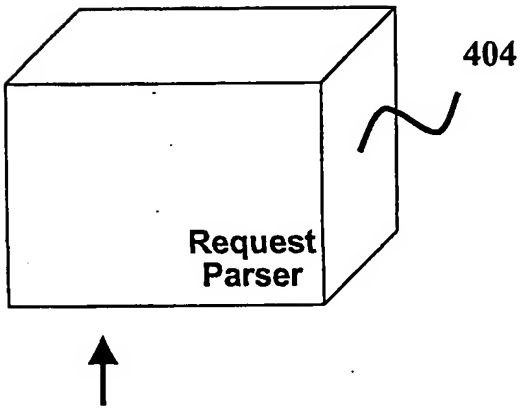

Fig. 4b

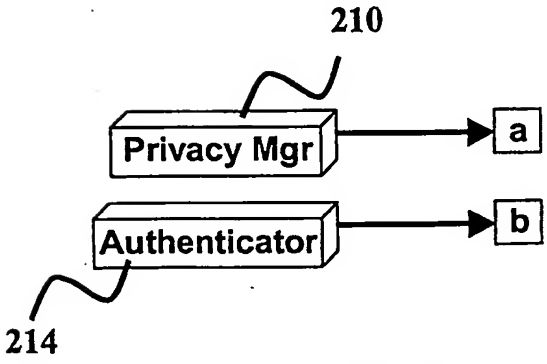

Fig. 4c

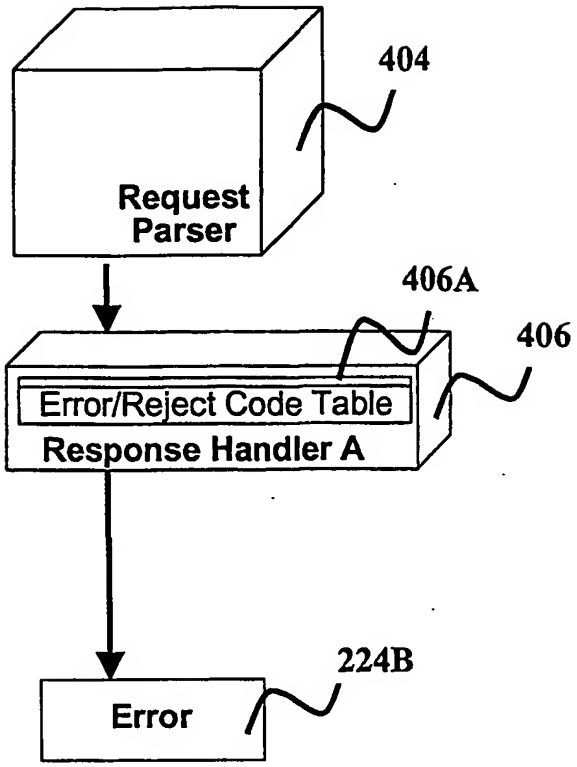
404
Request Parser
406A
406
Error/Reject Code Table
Response Handler A
224B
Error

Fig. 4d

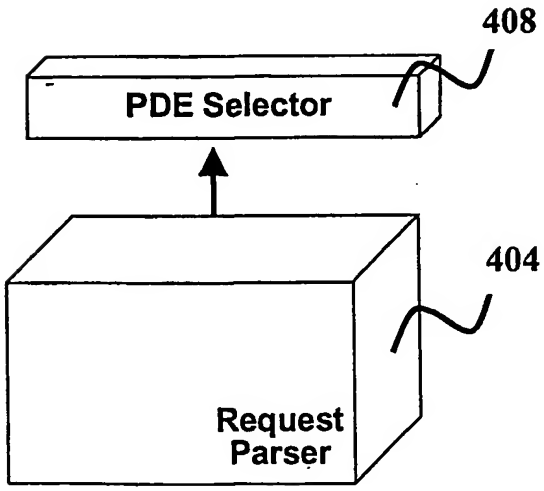
408
PDE Selector
404
Request Parser

Fig. 4e

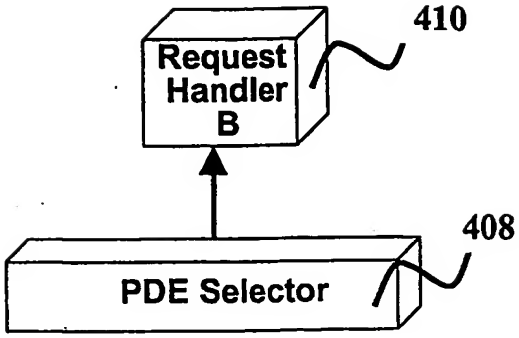
Request Handler B
410
PDE Selector
408

Fig. 4f

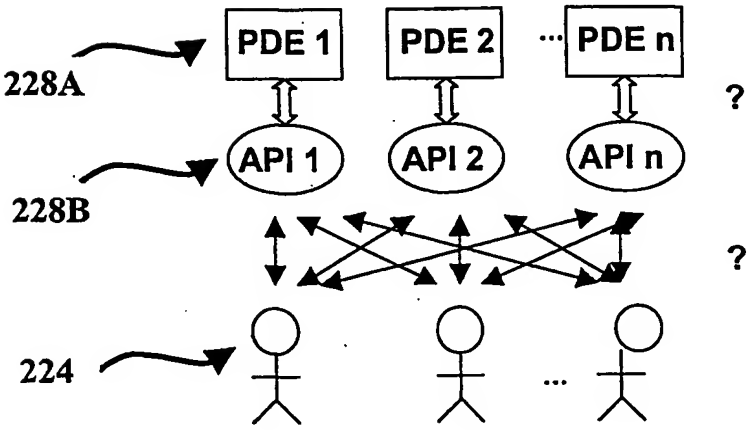
PDE 1
PDE 2
PDE n
228A
API 1
API 2
API n
228B
224
?
?

Fig. 4g

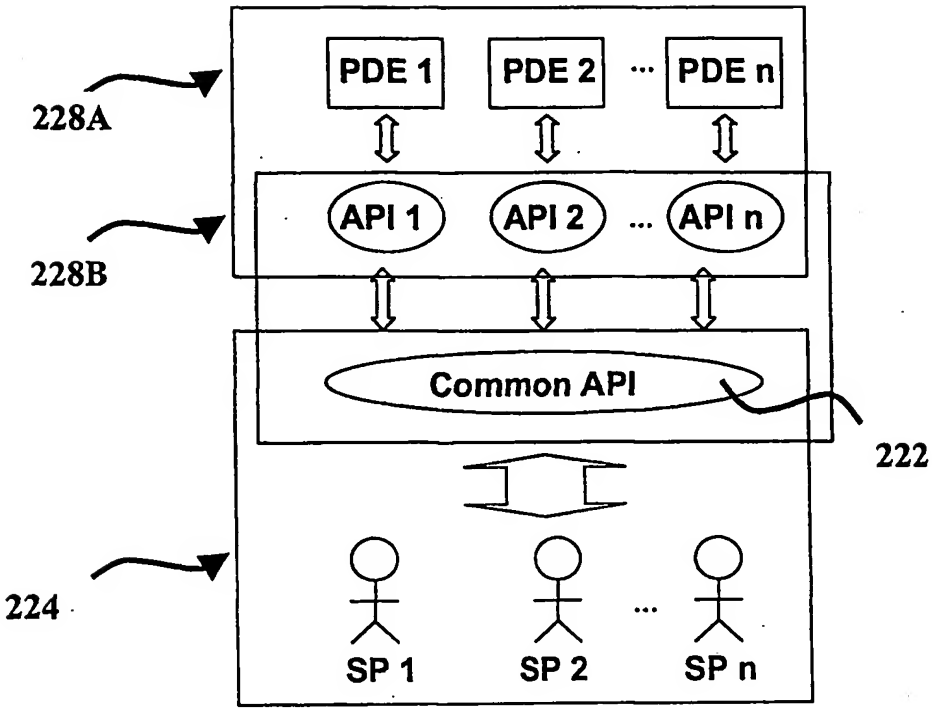
PDE 1
PDE 2
PDE n
228A
API 1
API 2
API n
228B
Common API
222
224
SP 1
SP 2
SP n

Fig. 4h

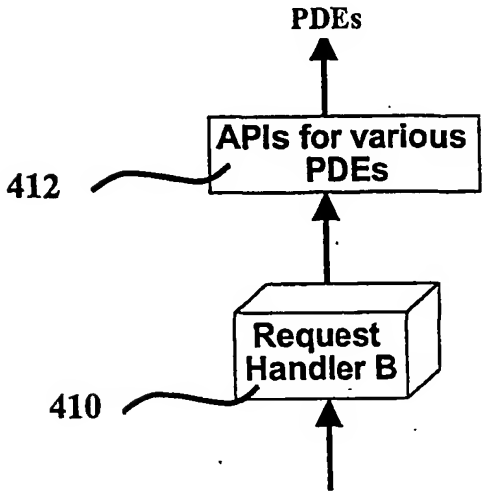
PDEs
APIs for various PDEs
412
Request Handler B
410

Fig. 4i

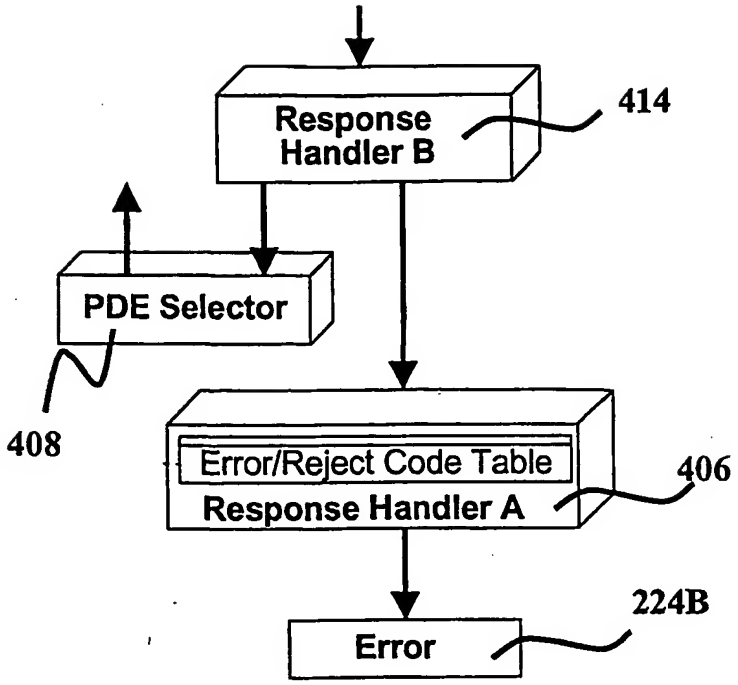
Response Handler B
414
PDE Selector
408
Error/Reject Code Table
Response Handler A
406
Error
224B

Fig. 4j

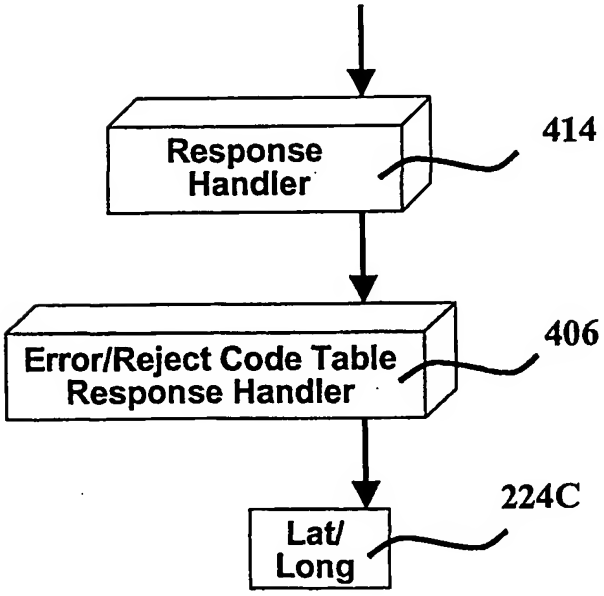
Response Handler
414
Error/Reject Code Table Response Handler
406
Lat/ Long
224C

Fig. 4k

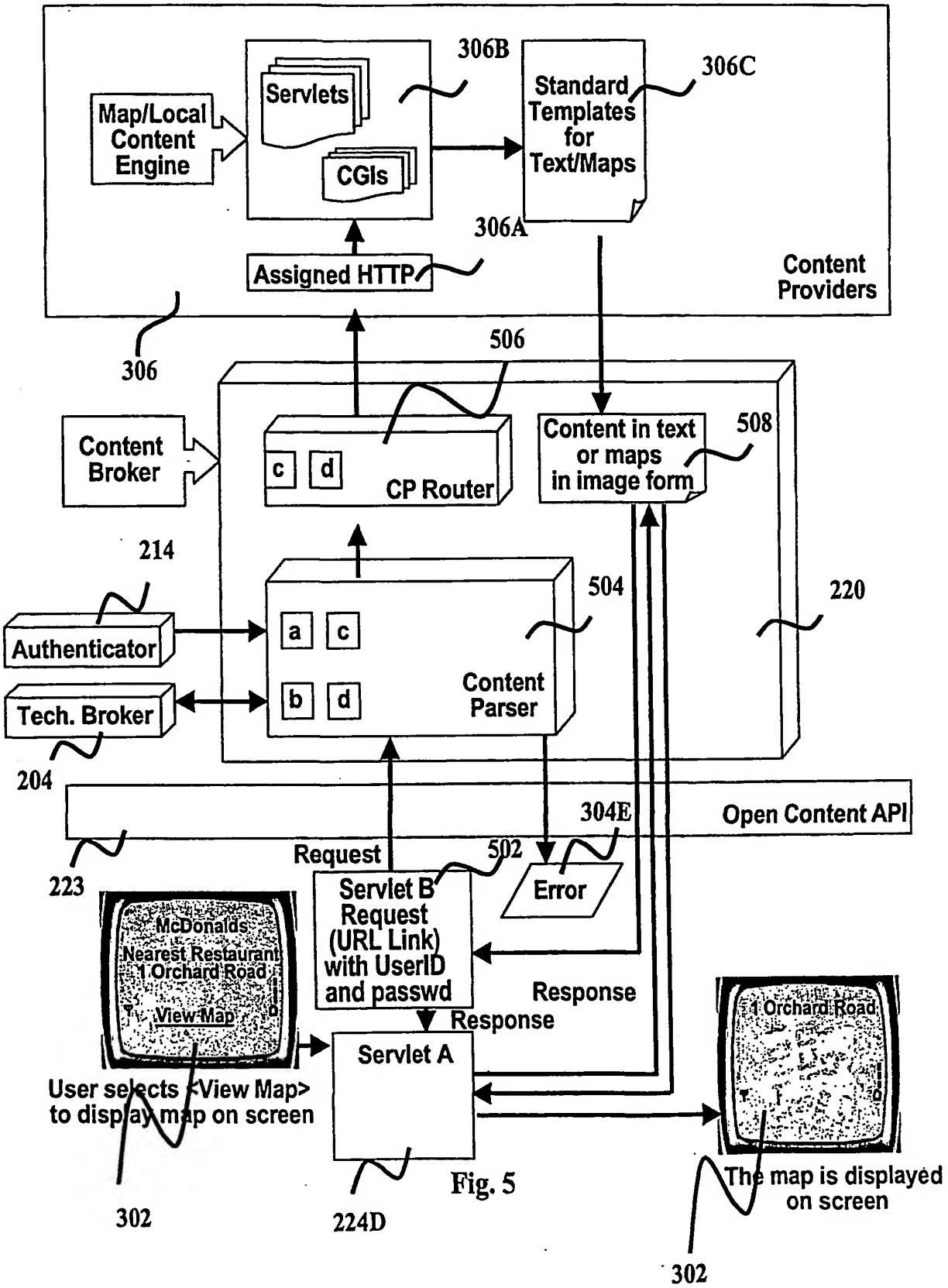
Map/Local Content Engine
Servlets
CGIs
306B
Standard Templates for Text/Maps
306C
306A
Assigned HTTP
Content Providers
306
506
Content Broker
c
d
CP Router
Content in text or maps in image form
508
214
504
220
Authenticator
a
c
Tech. Broker
b
d
Content Parser
204
304E
Open Content API
223
Request
502
Error
McDonalds
Nearest Restaurant
1 Orchard Road
View Map
Servlet B Request (URL Link) with UserID and passwd
Response
Response
Servlet A
1 Orchard Road
User selects <View Map> to display map on screen
The map is displayed on screen
302
224D
302

Fig. 5

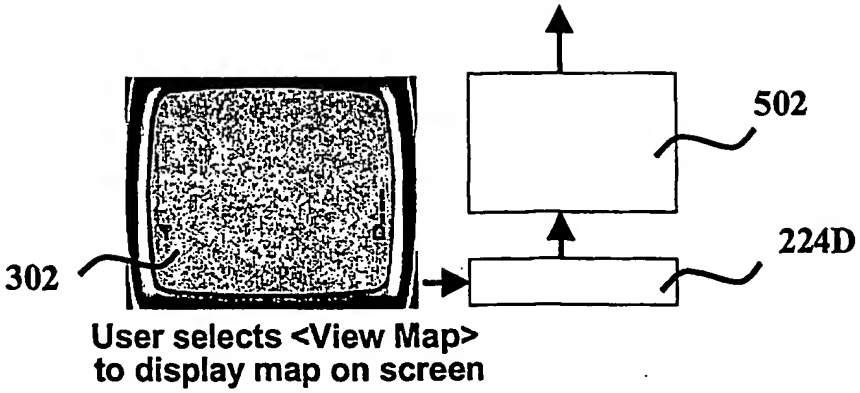

Fig. 5a

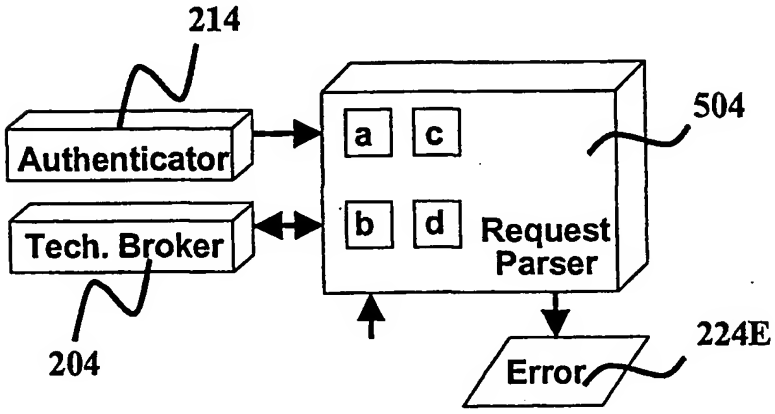

Fig. 5b

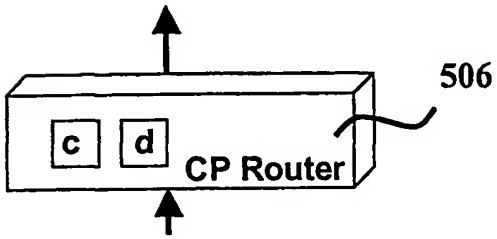

Fig. 5c

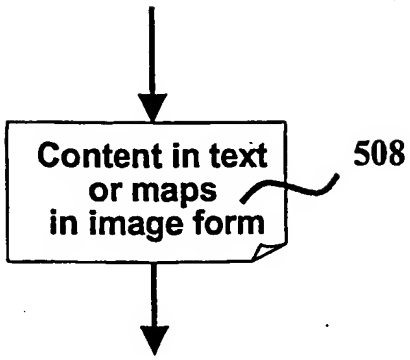
Content in text
or maps
in image form
508

Fig. 5d

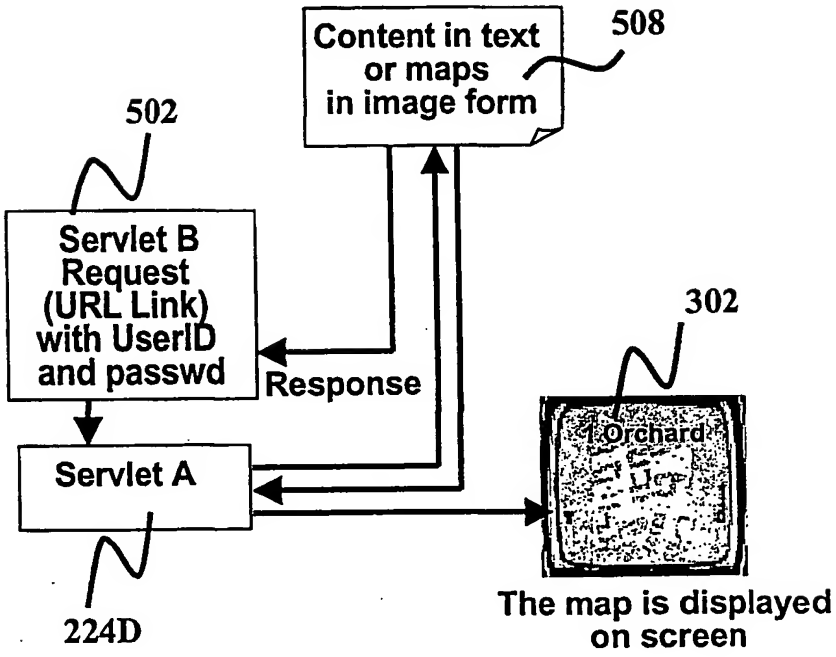
Content in text
or maps
in image form
508
502
Servlet B
Request
(URL Link)
with UserID
and passwd
Response
302
Orchard
Servlet A
224D
The map is displayed
on screen

Fig. 5e

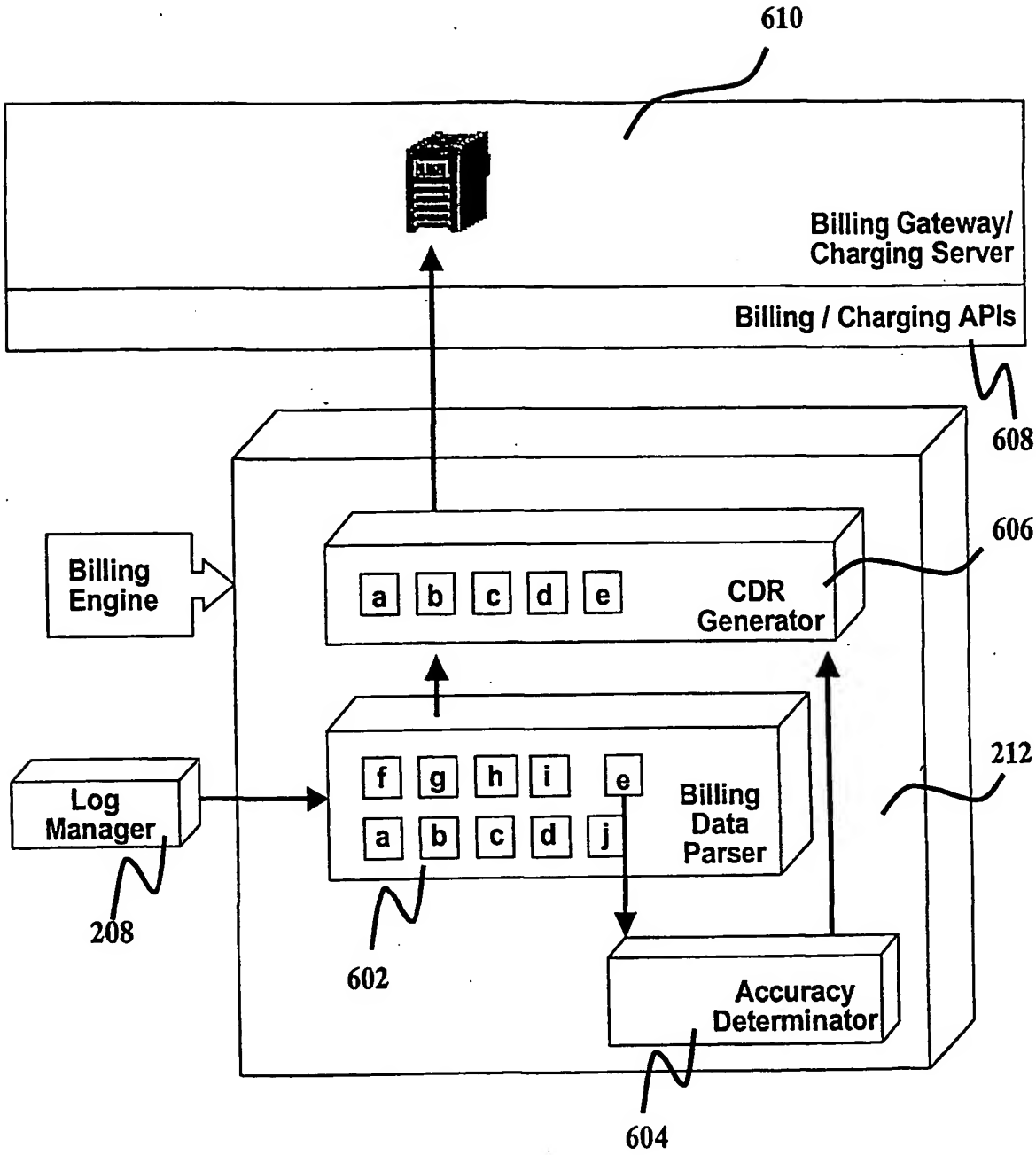
610
Billing Gateway/
Charging Server
Billing / Charging APIs
608
606
Billing
Engine
a b c d e
CDR
Generator
212
Log
Manager
f g h i e
a b c d j
Billing
Data
Parser
208
602
Accuracy
Determinator
604

Fig. 6

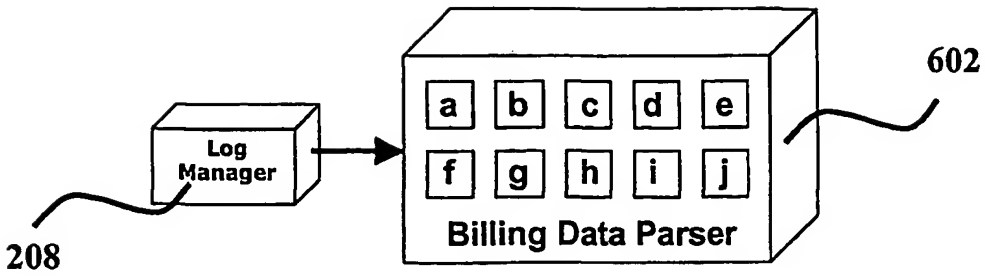

Fig. 6a

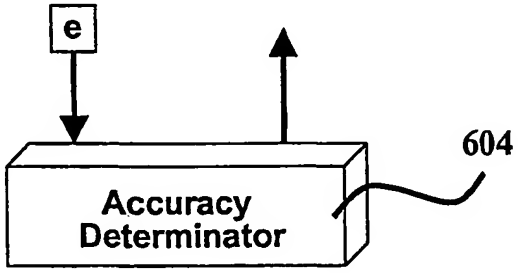

Fig. 6b

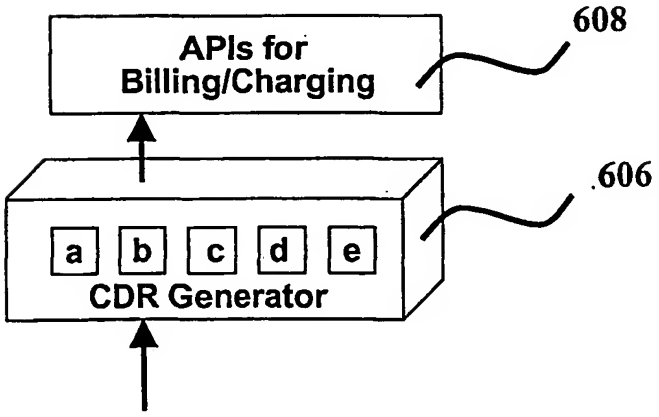

Fig. 6c

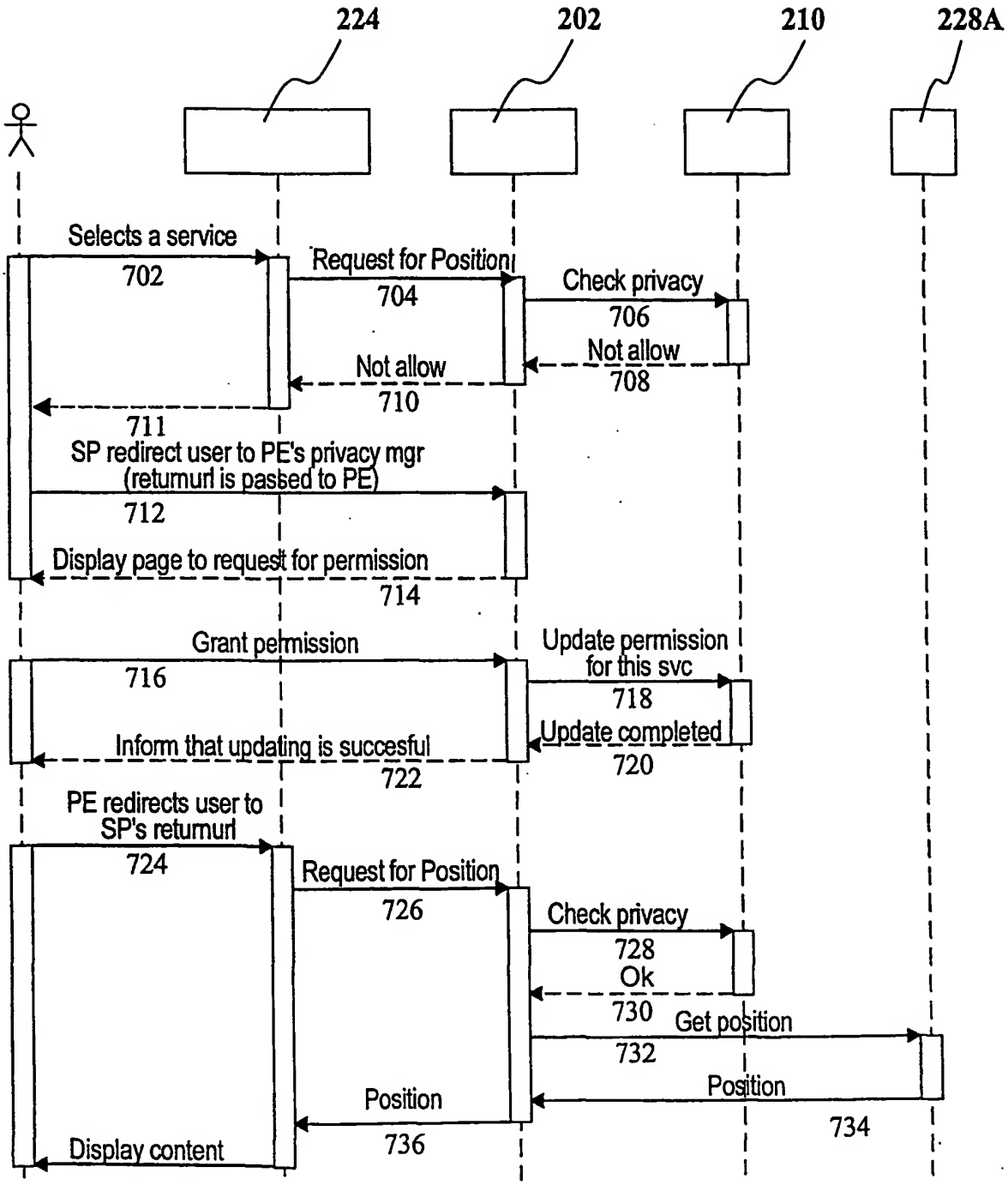
224
202
210
228A
Selects a service
702
Request for Position
704
Check privacy
706
Not allow
708
Not allow
710
711
SP redirect user to PE's privacy mgr
(returnurl is passed to PE)
712
Display page to request for permission
714
Grant permission
716
Update permission
for this svc
718
Update completed
720
Inform that updating is succesful
722
PE redirects user to
SP's returnurl
724
Request for Position
726
Check privacy
728
Ok
730
Get position
732
Position
734
Position
736
Display content

Fig. 7

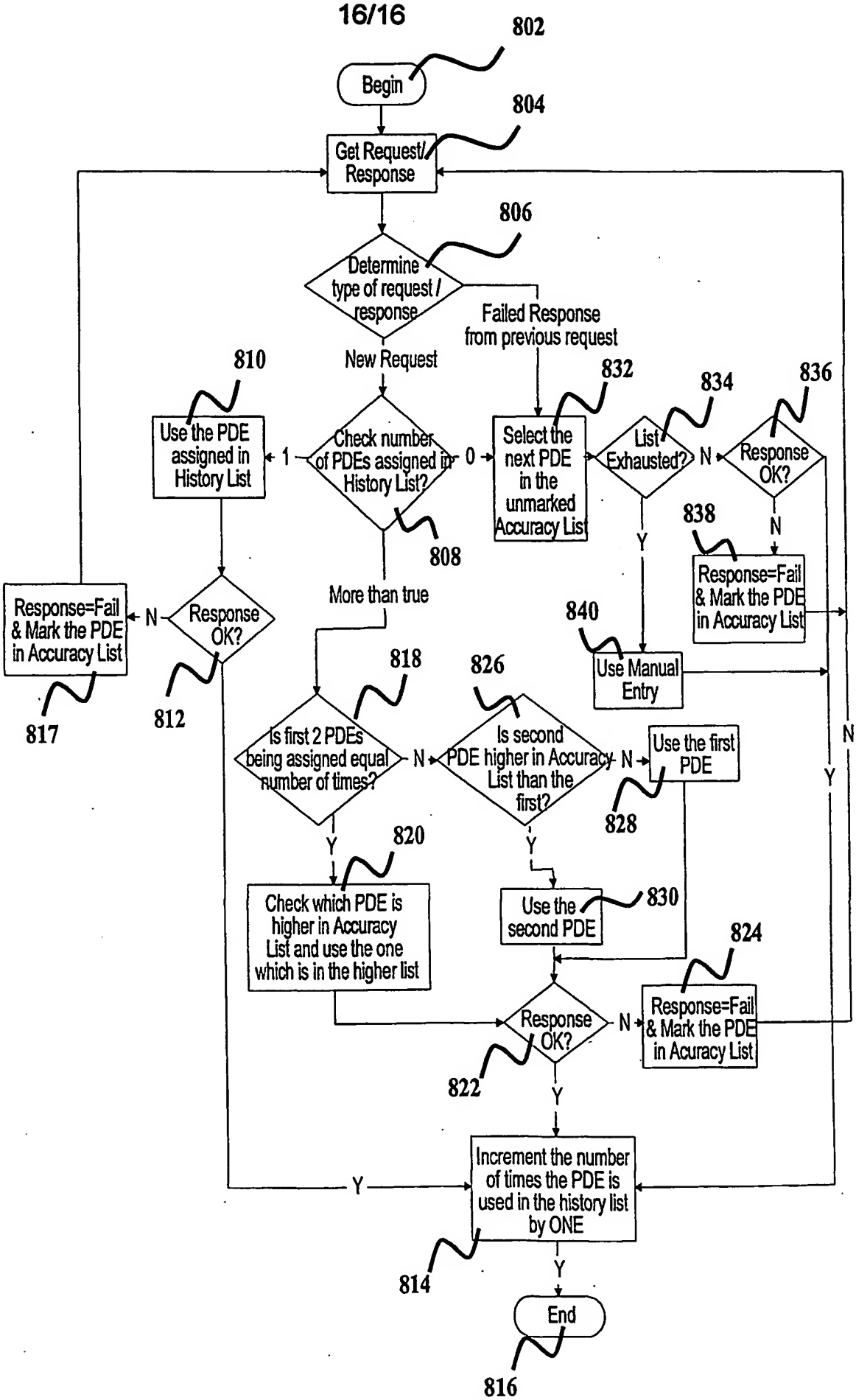
802
Begin
804
Get Request/ Response
806
Determine type of request / response
Failed Response from previous request
New Request
810
Use the PDE assigned in History List
1
Check number of PDEs assigned in History List?
0
808
832
Select the next PDE in the unmarked Accuracy List
834
List Exhausted?
N
836
Response OK?
N
838
Response=Fail & Mark the PDE in Accuracy List
Y
840
Use Manual Entry
More than true
Response=Fail & Mark the PDE in Accuracy List
N
Response OK?
817
812
818
Is first 2 PDEs being assigned equal number of times?
N
826
Is second PDE higher in Accuracy List than the first?
N
Use the first PDE
828
Y
Y
820
Check which PDE is higher in Accuracy List and use the one which is in the higher list
Use the second PDE
830
824
Response OK?
N
Response=Fail & Mark the PDE in Acuracy List
822
Y
Y
Increment the number of times the PDE is used in the history list by ONE
814
Y
End
816
N
Y

Fig. 8

INTERNATIONAL SEARCH REPORT

International application No.
PCT/SE 02/00076

A. CLASSIFICATION OF SUBJECT MATTER

IPC7: H04Q 7/38, G01C 21/32
According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)

IPC7: H04Q

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

SE,DK,FI,NO classes as above

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	WO 0004730 A1 (SIGNALSOFT CORP.), 27 January 2000 (27.01.00), p. 3, l.9-10; 24-25 - p.4,l.6-12; 24-32, p.5, l.1-17 - p.8, l. 20-29, p.9, l.3-10 - p.10, l.14-22; 32, p.11, l.5-10; 28-32 - p.12, l.1-13, p.13, l. 2-14, figures 1,3, abstract	1-14,17-19, 55-68
X	claims 1-5,10-12,16,21-24	1-14,17-19, 55-68
Y	abstract, pages, figures, claims: same as above	15-16,20-54, 69-83
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Y	WO 9707467 A1 (PHELAN, SEAN), 27 February 1997 (27.02.97), page 3, line 14 - line 36; page 4, line 14 - line 36; page 5, line 1 - line 14, page 6, line 17 - line 23, figure 3, claims 1-4,9, 13-15,17,19, abstract	15-16,20-54, 69-83
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[X] Further documents are listed in the continuation of Box C. [X] See patent family annex.

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Date of the actual completion of the international search	Date of mailing of the international search report
13 May 2002	22-05-2002
Name and mailing address of the ISA/ Swedish Patent Office Box 5055, S-102 42 STOCKHOLM Facsimile No. +46 8 666 02 86	Authorized officer ELISABETH ASELIUS/BS Telephone No. +46 8 782 25 00

C (Continuation). DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
P,X	FR 2807900 A1 (INOVATEL), 19 October 2001 (19.10.01), page 3, line 21 - line 30; page 4, line 8 - line 23; page 7, line 8 - line 23, page 14, line 23 - line 30, figure 1, claims 1-17, abstract --	1-83
A	WO 0101077 A1 (TELIA AB), 4 January 2001 (04.01.01), figure 2, abstract -- --------	1-83

INTERNATIONAL SEARCH REPORT

Information on patent family members

International application No.
PCT/SE 02/00076

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		EP 1194739 A	10/04/02
		NO 20015880 A	20/02/02
		SE 514052 C	18/12/00
		SE 9902418 A	18/08/00